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A COMPARISON OF INTRATHECAL AND EPIDURAL ANALGESIA AND ITS EFFECT ON LENGTH OF LABOR

Caroline McGrath Cutbush

APPROVED:

John P. McDonough, CRNA, EdD, Committee Chair	Date
Kenneth P. Miller, RN, PhD, Committee Member	Date
Kit R. Clark, CRNA, MA, Committee Member	Date

18 July 1997

APPROVED:

F.G. Abdellah, Ed.D., Sc.D., RN, FAAN	Date

CURRICULUM VITAE

Name: Caroline McGrath Cutbush

PII Redacted [redacted]

Degree and date to be conferred: Master of Science in Nursing 1997

PII Redacted [redacted]

[redacted]

Secondary Education: Danvers High School, Danvers, MA June 1983

Collegiate institutions attended:

Uniformed Services University of the Health Sciences Major: Nurse Anesthesia	June 1995- Sep 1997	M.S.N.	2 Oct 1997
University of Connecticut Major: Nursing	Sep 1983- May 1988	B.S.N.	22 May 1988

Professional positions held:

15 Nov 1997-	Keesler AFB, MS Certified Registered Nurse Anesthetist (CRNA)
5 Jun 95-15 Nov 97	Uniformed Services University of the Health Sciences (USUHS) 4201 Jones Bridge Road, Bethesda, MD 20814-4799 Student Registered Nurse Anesthetist (SRNA)
15 Oct 92 - 5 June 95	20th Medical Group, Shaw AFB, SC Assistant Charge Nurse, Labor and Delivery, Unit Staff Development Officer, Charge Nurse of ATH emergency ward, Charge Nurse of Casualty Collection Point for Readiness exercises. Unit Morale Officer.
1 May 89 - 15 Oct 92	355th Medical Group, Davis-Monthan AFB, AZ Staff Nurse, Special Care Unit, Unit Staff Development Officer, Unit Scheduler, Member of ATH deployment to Persian Gulf August 90- March 91.
22 May 88- 1 May 89	Hartford Hospital, Hartford CT, Staff Nurse, 30-bed Medical Ward.

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ABSTRACT

A retrospective study was conducted to determine the effects of intrathecal analgesia on length of labor. There have been a number of investigations which show contradictory evidence as to the effect of epidural (EPI) analgesia on the progress of labor. Combined spinal-epidural (CSE) and intrathecal analgesia (ITA) techniques have been used to provide effective pain relief for parturients, but currently there are few data comparing EPI, CSE, and ITA techniques and their effect on progress of labor. Intrathecal opioids provide immediate pain relief for the parturient without autonomic, sensory or motor blockade. All are associated with prolongation of labor and increased incidence of instrumental delivery. A 1995 study reported CSE for labor analgesia is associated with shorter duration of first stage in primiparas (Campbell et al.). The last two hundred thirteen uncomplicated obstetric charts were reviewed in a 70-bed Air Force hospital which currently provides EPI, CSE, and ITA for their obstetric department. The study consisted of four groups: (1) CSE n=76 (2) EPI n= 41 (3) ITA n=49 and (4) NR (no regional analgesia) n=47. Demographic data was also collected. It was found that length of first stage labor was significantly less for those who received ITA ($p<.001$) as compared to all other groups. Second stage labor was significantly shorter for the NR group as compared to CSE ($p=.000$) and EPI ($p=.006$) groups. There was no significant difference between length of second stage for ITA and NR groups. ITA analgesia shortened first stage most significantly ($p=.006$) in both primiparas and multiparas. Stage two was significantly prolonged for both primiparas ($p=.047$) and multiparas ($p=.012$) in the CSE group. Since CSE analgesia during labor is both versatile and requires less re-dosing of the epidural catheter, thus less manpower hours, implications for use in anesthesia departments unable to offer a full obstetric regional analgesia service are made.

A COMPARISON OF INTRATHECAL AND EPIDURAL ANALGESIA AND ITS EFFECT ON LENGTH OF LABOR

by

Caroline McGrath Cutbush, BSN

THESIS

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DEDICATION

I dedicate the creation of this thesis to my mother, my father, and my husband.

To my mother, a Registered Nurse, whose example of sharp intellect and sense of independence drives me to succeed. Whose sense of humor always lightens my way and whose unique laughter still rings in my head. A true revolution of her generation, a fighter, who perfected the art of debate. A diamond, hard and rough, yet when examined closely, a beauty and sparkle beyond all imagination. Above all, one who possessed an incredibly generous heart, giving to all who entered her path in this life.

To my father, an educator, whose quiet devotion to his children is reflected by the distinct achievements of all six of us. This thesis, comprising only a small portion of the successes that my family has enjoyed. My father exemplifies discipline and integrity, and has instilled, in some measure, these qualities in every student he has tutored.

To my husband Ken whose love and support has been unbounded through this whole process. Whose smile makes me smile even when I have been sitting at the computer for sixteen hours. I can probably never repay the debt of understanding and gentle encouragement you have provided me in attaining this degree. I look forward to our future without the constant stress of exams and thesis crises. To the man I will spend the rest of my life with, thank you for all you do for me.

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CHAPTER ONE

Introduction

Background of the Problem

Pain control for labor and delivery has been a source of debate throughout the obstetric anesthesia community for several years. The controversy focuses on the effects of the chosen method of delivery of analgesia on the outcome and progress of labor and delivery. Bromage in 1981 editorialized his opinion that pain relief, for any ailment, has always been provided at a price. In the case of parenteral narcotic analgesia, dose-dependent relief of pain mediated through central mechanisms is provided at the expense of central respiratory mechanisms. For regional analgesia, namely continuous epidural infusion, it provides pain relief in a segmented fashion without central depression, therefore eliminating the risk of respiratory depression but still involves a price in terms of complex clinical management, hypotension and bradycardia from sympathectomy, and a high incidence of urinary retention. The side effects of these methods of pain control are even more complex for obstetrics. Unfortunately, the obstetric literature contains contradictory reports on specific drugs, modes of delivery of the drug to its site of action, and their effect on the progress of labor (Friedman, 1978).

Despite the inconsistent information, regional anesthesia has gained popularity over the last several decades for use in obstetrics. It is effective, and when properly administered, it is relatively safe for the relief of pain associated with labor and delivery (Shnider, Levinson, & Ralston, 1993). There exists an abundant variety of techniques, modifications of these techniques, and assorted drug combinations. Several studies have been published advocating one method over another.

The use of epidural anesthesia for labor and delivery has markedly increased since its introduction in the early 1930's. The increase began in Scandinavia and Great Britain, spreading to the United States in the 1960's (Schussman, Woolley, Larsen, & Hoffman, 1982). In 1982, Schussman et al., reported that epidural anesthesia was used in ninety percent of all vaginal deliveries at that time and that obstetricians and anesthesiologists stated epidural anesthesia was the anesthetic of choice for most women. It is also well documented that epidural analgesia for vaginal delivery is reported to prolong the course of labor (Chestnut, Vincent, McGrath,Choi, & Bates, 1994); (Kilpatrick & Laros, 1989); (Wood, Huig-Ng & Hounslow, 1973). For this reason, epidural infusion of a low concentration of anesthetic has become an acceptable alternative to intermittent bolus as a method of pain relief in labor. Benefits of this method include stable continuous analgesia with minimal motor blockade, a reduced level of systemic toxicities and a decreased incidence of hypotensive episodes (Milaszkiewicz et al., 1992).

Regardless of the regional technique employed, most obstetric and anesthesia providers agree, anesthesia should be commenced only after active labor is well established. Active labor is defined as the presence of strong contractions lasting one minute and occurring every three minutes with concurrent cervical progression of effacement and dilation (Martin, 1990). Lumbar epidural anesthesia provides relief of pain in both first and second stage of labor by either intermittent injection or by continuous infusion. The introduction of intraspinal narcotics into clinical practice has added an enormously useful dimension to epidural analgesia for management of pain in labor (Hughes, 1993).

In 1976, and then again in 1977, scientists published their discovery of opiate receptor sites in the rat brain (Pert, Kuhar, & Snyder, 1976); (Atweh & Kuhar, 1977). The fact that high

densities of opiate receptors were concentrated in the dorsal column of the spinal cord, specifically the substantia gelatinosa, suggested a new mechanism for the analgesic action of opiates at spinal levels (Atweh & Kuhar, 1977). After animal studies of the administration of morphine directly into the spinal subarachnoid space (SAB) of the rat produced profound analgesia, anesthesiologists at the Mayo clinic studied the effect of intrathecally applied morphine in eight patients suffering from intractable pain of inoperable cancer (Wang, Nauss, & Thomas, 1979). In response to the successful management of acute and chronic pain by intrathecal opioid administration, twelve obstetric patients in active labor received a single SAB injection of 1.5 mg of morphine (Scott et al., 1980). The results of this study were not congruent with other studies; labor pain was not controlled for many of the subjects. Later, in 1981, a similar study was conducted at American University Medical Center in Beirut, Lebanon, which found that an injection of 1 or 2 mg or morphine intrathecally can completely relieve visceral labor pain for eight to eleven hours, without the incidence of motor or autonomic blockade (Baraka, Noueihid, & Hajj, 1981).

The use of intrathecal and epidural opioids in obstetrics has become widespread in recent years (Camann, Minzter, Denney, & Datta, 1992). In particular, the epidural administration of opioids has gained popularity in various settings as a sole analgesic agent or as an adjunct to low-dose local anesthetic regimens (Datta, 1992). In addition, the use of low dose local anesthetic solutions in a continuous epidural infusion with an initial dose of intrathecal opioids, has allowed for excellent analgesia with a low incidence of side effects such as hypotension or motor blockade (Abouleish, Abouleish, & Camann, 1994). The term used to describe this procedure is the combined spinal-epidural technique, (CSE). The rationale for the addition of intrathecal opioid is

to enhance the quality of the block without increasing the incidence of bothersome side effects. The addition of an intrathecal opioid may also permit the laboring patient to ambulate during first stage of labor (Campbell et al.1995a).

Rationale and Significance of the Problem

As stated above, there exists a technique that combines spinal with epidural blockade. When used for obstetrics the spinal dose usually consists of an opioid, and occasionally, low doses of local anesthetic, a dose that is considered inadequate for motor blockade. The local anesthetic is believed to enhance the duration of analgesia (Campbell, Camann, & Datta, 1995b). The combined spinal-epidural (CSE) block was first described as an anesthetic technique for cesarean section by Brownridge (1981). Brownridge used two injections in separate interspaces to accomplish the block. A year later Coates (1982), reported a modification in which a "needle-through-needle", single interspace technique was utilized. The principle of the procedure is to locate the epidural space with an epidural needle, through which a spinal needle is advanced into the subarachnoid space. Once the tip of the spinal needle is properly positioned, the spinal dose is administered, and then the spinal needle is withdrawn. An epidural catheter is then passed into the epidural space for either immediate or future use (Covino, Scott, & Lambert, 1994). The CSE technique offers several advantages over other procedures that make it an interesting obstetrical anesthetic option. It affords the rapid onset of spinal analgesia with the versatility of epidural analgesia (Abouleish et al., 1994).

Another consideration in delivering pain relief to parturient women is manpower. Management of continuous epidural anesthesia is time consuming and requires on-site availability of anesthesia providers. It may also prevent the anesthetist from providing anesthesia for surgical

emergencies that may arise (Keller & Elliot, 1995). Because of these reasons this technique is often under utilized. Recall, that in the early 1980's epidural anesthesia was reported to be used in ninety percent of all vaginal deliveries (Schussman et al., 1982). In 1989, it was reported that lumbar epidural analgesia, although very effective at relieving labor pain, is actually received by only sixteen percent (16%) of laboring patients in the United States (Leighton, DeSimone, Norris, & Ben-David, 1989). This figure was based on a national survey conducted in 1986. In their study, Leighton et al., hypothesized that the use of intrathecal narcotic analgesia could provide effective yet inexpensive analgesia for laboring women who subscribed to a health maintenance organization which was unwilling to pay for epidural analgesia. Their conclusions supported their hypothesis and the group now offers both intrathecal narcotic and epidural analgesia to their laboring patients, with intrathecal narcotics constituting about eight percent (8%) of the labor anesthetics they administer.

Concerning quality of analgesia, Rust, Waring, Hall, & Nelson (1993) found intrathecal narcotics to be very effective in relief of pain in the first stage of labor with the major advantages being no motor weakness, rapid onset of analgesia, increased availability due to less intense requirements on anesthesia staff and reduced costs. The authors currently use intrathecal narcotics in accordance with their protocol in twenty-one percent (21%) of their laboring patients. In 1992, the Department of Defense made the availability of lumbar epidural to all laboring patients mandatory (Zapp & Thorne, 1995); (A. M. Sloan, personal communication, December 3, 1992). Before this time women who delivered in a military health care facility did so under IV or no analgesia. When this mandate was issued it put a considerable strain on anesthesia services in all branches of military service related to the lack of manpower to meet the demands of a new

labor epidural service (D. E. Eickhoff, personal communication, March 12, 1992); (Zapp & Thorne, 1995).

In response to the increased demand for labor epidural services a study was conducted to ascertain whether an alternative existed that would meet the requirements of the new mandate, but not necessarily require an expansion of anesthesia manpower. The study was conducted at a military facility to measure the effectiveness of intrathecally injected opioids in relieving pain during the first stage of labor. Results of the study concluded intrathecal analgesia as an alternative is cost effective, less labor intensive for the anesthesia provider, with patients reporting they felt well rested for second stage, of which pain control included local infiltration for episiotomy only (Zapp & Thorne, 1995).

Statement of the Problem

Pain control for labor and delivery often produces unwanted side effects such as, maternal hypotension, motor blockade, and decreased uterine activity. More specifically, epidurally administered bupivacaine provides effective analgesia for the first stage of labor, but is often associated with maternal hypotension, which can reduce uterine perfusion, and with motor blockade, which may interfere with maternal expulsive forces. These unwanted side effects are due to the non-specific neural blockade of bupivacaine (D'Angelo, Anderson, Philip, & Eisenach, 1994). An ideal labor analgesic should have a rapid onset and long duration. It should provide consistent pain relief while minimizing the monitoring time required by physicians and nurses . Its use should not alter the normal progress of labor or its outcome (Herpolsheimer & Schretenthaler, 1994). Lumbar epidural analgesia frequently fails to meet this criterion (Leighton et al., 1989) because up to half of the women receiving lumbar epidural analgesia have at least partial motor

blockade at the time of delivery (Chestnut, Vandewalker, Owen, Bates, & Choi, 1987). Epidural or intrathecal injection of opioids has the potential to provide selective analgesia without such effects, because they act on spinal opiate receptors without affecting motor neurons, preventing motor blockade (Yaksh & Rudy, 1977). With the advent of lowering the dosage concentrations of epidural local anesthetics, the effects of maternal hypotension and motor blockade have been partially attenuated. Dose-related decrease in pain control are also experienced. Therefore, the addition of opioids to epidural infusions has been instituted.

Effects on uterine activity remain somewhat controversial since after several clinical trials contradictory evidence still exists pertaining to this issue (Miller, DeVore, & Eisler, 1993). Selective opioid analgesia whether epidural or intrathecal has also resulted in conflicting reports. However, most studies document inconsequential effects on uterine activity, as compared to epidural methods, especially when lipophilic agents are used, such as fentanyl or sufentanil over morphine (hydrophilic). Thus, the issue here is length of labor. How do epidural and intrathecal analgesics compare in their effects on length of each stage of labor? The effects of these methods of obstetric pain control on uterine contractions reflects their influence on the first stage of labor. The effects of these methods on expulsive forces reflects their influence on the second stage of labor. A sum of the two stages signifies total length of labor. The question then, is: what method of pain control delivery has the least untoward effects on length of each stage of labor and on total labor?

Purpose of the Study

The purpose of this study is to determine how the intrathecal technique can influence the length of each stage of labor in comparison to epidural alone or no regional anesthesia/analgesia.

The intrathecal (ITA) and combined spinal epidural (CSE) techniques decrease motor blockade by providing pain relief through a separate mechanism. That is, the binding of opiate receptors by the intrathecally injected opioid. Patients receive similar relief of pain through injection of local anesthetic which stops the nerve conduction of pain, but is also often associated with nerve conduction blockade of sympathetic impulses causing vasodilation leading to hypotension, and motor impulses. Blockade of theses impulses in turn interfere with uterine perfusion and maternal expulsive forces affecting progress of labor. ITA or CSE relieve pain, require less local anesthetic, and also the CSE offers the versatility of epidural injection later in labor for additional pain relief.

Preliminary results reported in a study of combined spinal-epidural (CSE) using the combination of sufentanil (10 μg), bupivacaine (2.5 mg), and epinephrine (0.2 mg) reflect a decrease in the duration of first stage of labor in nulliparous women (Campbell et al., 1995a). No studies found in the review of literature focus on the effects of second stage or of total labor. Further study is required in this area because CSE is a method which has shown to be a cost effective, high quality analgesic, which may allow the patient to ambulate and could even decrease the duration of first stage of labor. The military relevance of this study is to illustrate how a technique, which is already in practice at a military treatment facility, provides excellence in quality care without requiring an increase in the manpower of the anesthesia department. In these times of cost containment and maximal utilization of personnel while simultaneously upholding highest quality patient care, CSE technique offers a compromise for the challenges of both these

issues.

Null Hypotheses

For this study it is hypothesized that:

1. It is hypothesized that there is no difference in the length of first stage labor for parturients receiving intrathecal analgesia as compared to those receiving epidural analgesia or no regional analgesia.

2. It is hypothesized that there is no difference in the length of second stage labor and incidence of instrumental delivery for parturients receiving intrathecal analgesia as compared to those receiving epidural analgesia.

3. It is hypothesized that there is no difference in total length of labor for parturients receiving intrathecal analgesia as compared to those receiving epidural analgesia.

Dependent Variables

1. The length in minutes of the first stage of labor.

2. The length in minutes of the second stage of labor.

3. The length in minutes of the sum of the two stages which signifies total labor.

Theoretical Definitions

For the purposes of this study the following definitions of terms and concepts are used.

Analgesia: Diminished sensation of pain, particularly the relief of pain without loss of consciousness.

Epidural analgesia: Analgesia produced by introduction of the analgesic agent, opioid, into the epidural space of the vertebral canal.

Spinal analgesia: Analgesia produced by introduction of the opioid into the subarachnoid

space of the vertebral canal.

Anesthesia: Loss of feeling or sensation produced by a number of agents capable of bringing about partial or complete loss of sensation. It is induced primarily to permit the performance of surgery or other painful procedures.

Epidural anesthesia: Anesthesia produced by injection of the anesthetic agent between the ligamentum flavum and the dura into the epidural space, also called the extradural or peridural space.

Spinal anesthesia: Anesthesia produced by injection of the anesthetic agent into the subarachnoid space between the subarachnoid mater and the pia mater, usually produces differential block of motor, sensory, and autonomic neurons.

Local anesthetic: A chemical agent which produces blockade of nerve conduction resulting in transient loss of sensory and/or motor function in a specific region of the body.

Regional anesthesia: Injection of local anesthetics into a particular area of the body to produce temporary loss of sensory and/or motor capabilities.

Conduction anesthesia: The lack of sensitivity produced by a local anesthetic injection into the nerve sheath or tissues.

Opioids: Chemical substances which are either endogenous or exogenous to the body that bind specifically to any of the several opioid receptors and produce some agonist opiate effects. Opioids can be administered to produce analgesia without loss of touch, proprioception, or consciousness.

Sensory blockade: The interruption of neuronal conduction of sensory neurons which produces loss of sensation to superficial and deep touch, temperature, and pain.

Motor blockade: The interruption of conduction of motor neurons which impairs or produces inability to consciously move an extremity.

Sympathectomy: The blockade of sympathetic neuronal conduction arising from thoracolumbar spinal segments resulting in systemic vasodilation, possibly leading to hypotension.

Hypotension: Hypotension is a decrease in systolic blood pressure by more than 20% from patient's baseline.

Uterine activity: The frequency of contraction of the uterus and the pressure generated by these contractions (Miller, DeVore, & Eisler, 1993).

Progress of labor: Increasing cervical dilation and effacement and the descent of the presenting part of the fetus in the maternal pelvis (Friedman, 1978).

Dilation: The gradual opening of the cervix of the uterus.

Effacement: The thinning, softening, and relaxation of the lower portion of the uterus as the myometrial fibers relax and become longer; this is to facilitate fetal expulsion during the second stage of labor.

Operational Definitions

Labor is classically divided into four functional divisions or stages:

First stage of labor: First stage of labor is defined as the time in minutes from the start of active labor to the time of complete cervical dilation and effacement (Friedman, 1978). For the purposes of this study first stage of labor in patients receiving combined spinal epidural technique (CSE) or epidural will be defined as the time of the first injection until complete cervical dilation and effacement. Patients receiving no regional analgesia will follow the usual definition of first stage of labor.

Second stage of labor: The classical definition of the second stage of labor is the time in minutes from full cervical dilation (as above) to the time of delivery of the fetus (Friedman, 1978).

Maternal expulsive forces: Describes the ability, energy, or willingness the parturient possesses in participation of delivery of the fetus; whether or not the mother can push the baby out independently.

Instrumental delivery: Delivery of the fetus through the vagina with a device such as forceps or vacuum extraction.

Summary

Many aspects of pain control in obstetrics are controversial and require compromise between the level of analgesia and incidence of detrimental side effects. There has been no clear evidence advocating one method over another. Using low dose local anesthetics in combination with a narcotic agent in a continuous or intermittently dosed epidural catheter can provide adequate relief of labor pain with few side effects. However, the more conventional methods of analgesia, epidural intermittent injection or continuous infusion, often come at a cost of manpower hours, taking anesthesia care providers away from their duties in the operating room and require higher doses, thus greater expense due to usage of larger amounts of analgesic agents. Leighton et al. (1989) found that intermittent epidural injections for relief of pain during labor requires injections to be repeated every 90 minutes, whereas continuous epidural infusions need to be checked hourly. These expenses often limit the availability of labor analgesia to patients who would ordinarily prefer it. Combined spinal epidural technique (CSE) offers a solution to these problems. It can be instituted to circumvent the under utilization of lumbar epidural pain control for labor and delivery at a much lower price. Cost effective in terms of man-hours, money, and

the expense of patients experiencing pain needlessly. The CSE technique provides excellent labor analgesia with rapid onset, leaving motor function and sympathetic tone intact. The presence of an epidural catheter allows the anesthetist a great deal of latitude. It can be used to provide a supplemental local anesthetic dose at the time of delivery. It can be used to administer a suitable block for cesarean section, if that becomes necessary. It may therefore avoid the risk of rapid-sequence induction in patients of an already high risk category (Keller & Elliott, 1995). CSE technique also provides many benefits to the patient as well, other than rapid onset of pain relief, the patients are not subject to the problems of immobility resulting from lumbar epidural with the incidence of hypotension and motor blockade. In reports published using CSE, patients have routinely been allowed to ambulate during first stage of labor without apparent difficulty (Abouleish et al., 1994). Finally, as mentioned previously, CSE technique may even decrease the duration of first and second stage of labor.

CHAPTER TWO

Review of the Literature

Pain control methods for labor have long been implicated as one of the causes of prolonged labor. Whether it be sedation with intravenous agents, caudal block, or epidural anesthesia, all have been investigated at one time or another to determine their effects on length of each stage of labor. For decades studies have resulted in contradictory evidence. In 1955, Emanuel Friedman wrote "that caudal anesthesia, properly applied, does not alter normal labor". This is in contradiction to the impression held by many and it becomes apparent that the 'proper application' is a vital point. He goes on to conclude that "It is evident that the deleterious effects wrought by other factors--for example, bony dystocia-- are enhanced by conduction anesthesia" (p. 580). As illustrated, it is difficult to discern what factors actually contribute to prolongation of labor, especially in a parturient who may already be at risk for protracted labor. The preliminary results of a 1995 study, present evidence that intrathecal opioids injected during the performance of combined spinal-epidural technique are not associated with prolonged labor. In fact, the duration of first stage of labor for primiparous women is significantly less than the mean time for first stage (Campbell et al., 1995a).

Conceptual Framework

There are three stages of labor. The first stage begins with the onset of regular uterine contractions and ends when the cervix is completely dilated and effaced. The second stage begins with complete dilation and ends with the birth of the infant. The third stage begins with the expulsion of the infant and ends with the delivery of the placenta. Some clinicians identify a fourth stage of labor. During this stage, which lasts 1-4 hours after delivery of the

placenta, the uterus effectively contracts preventing excessive bleeding at the placental site (Martin, 1990). For this study, the third and fourth stage of labor will not be measured. There are no documented studies of analgesics affecting length of third or fourth stage of labor.

The first stage of labor is divided into the latent and active phase. Latent labor begins with the onset of regular contractions with the beginning of cervical dilation to about 3-4 cm and effacement, but no fetal descent is evident. Friedman (1978) further described and defined the active phase, according to cervical dilation, as acceleration phase, phase of maximum slope, and deceleration phase. The acceleration phase occurs as the cervix begins to dilate very rapidly. The phase of maximum slope is the point of greatest cervical dilation as plotted on a graph of time vs. dilation. The deceleration phase designates a decrease in the rate of cervical dilation. This occurs prior to complete dilation.

In addition, Friedman developed concepts based on the physiologic objectives of labor, calling them preparatory, dilational, and pelvic divisions. The preparatory division (latent labor) includes the latent and acceleration phase of cervical dilation, the dilational division (active labor) includes the phase of maximum slope, and the pelvic division commences with the deceleration phase.

During the active phase of labor, the cervix dilates from 3-4 cm to 10 cm which marks the end of the first stage. Fetal descent is progressive. The rate of cervical dilation should be at least 1.2 cm per hour for primiparas, and 1.5 cm per hour for multiparas. The overall length of the first stage of labor is shown in Table 1.

Table 1.

Length in Hours of First Stage of Labor

	Average (hr)	Upper normal (hr)
Primiparas	13.3	28.5
Multiparas	7.5	20

The overall length of second stage of labor is .76 hours for primiparas and .32 hours for multiparas (Friedman, 1978).

Review of the Literature

It has been well documented and taught in obstetric anesthesia that regional anesthesia administered in the latent phase of labor will significantly prolong labor, whereas the same technique applied when labor is well established will have little or no effect (Miller et al., 1993). However, it is important to note there is considerable literature that reports prolongation of first stage of labor with regional technique, specifically lumbar epidural. Willdeck-Lund, Lindmark, and Nilsson (1979), reported a transitory decrease in uterine activity in all subjects after segmental epidural block was applied. Their study divided the subjects into two groups, according to whether or not oxytocin was given to stimulate contractions. The study directly measured uterine activity with intra-uterine pressure catheters and was expressed in Montevideo Units. Surprisingly, the decline in uterine activity was stronger in the oxytocin treated group than in women with spontaneous, unstimulated labor. The authors state in their discussion that other factors, for instance, breech presentation, were also associated with the oxytocin group. The

authors go on to suggest that these factors may account in part for the greater length of first stage in this group of patients. No differences were found between agents, lidocaine with epinephrine or bupivacaine with epinephrine, in depression of uterine activity (Willdeck-Lund et al., 1979).

In 1965, Friedman reported a study on several drugs, with varying modes of delivery of the drug to the site of action, and their effects on uterine contractility. In reference to epidural anesthesia and its effects on second stage labor, he attributes delay of second stage to inefficient flexion and rotation of the fetal presenting part pertaining more to the diminished voluntary rectus muscle expulsive force, resulting from anesthetic abolition of the perineal reflex, than to the effect of myometrial function (Friedman, 1965).

In a study in 1989, the length of first and second stages were measured retrospectively in parturients who were considered in normal labor, that is, no oxytocin was administered and no instrumental deliveries were preformed. The authors compared the mean length of each stage of labor with patients receiving no analgesia and those receiving conduction analgesia. The subjects were then subdivided into primipara and multipara groups. The results of the study concluded that the use of conduction anesthesia significantly increased the first and second stages in both primiparous and multiparous groups. The increase was approximately 2 hours in the first stage and 20-30 minutes in the second stage (Kilpatrick & Laros, 1989). The authors did not describe the agents used in the conduction anesthesia, although ninety-five percent of their patients received epidural and the remainder of the subjects received a saddle block, usually placed during second stage.

In a study conducted in 1982 on low-risk obstetrical patients, it was found that the length of first and second stage of labor was prolonged by the standard epidural technique described by

Dodliotti in 1933, but the prolongations were not of major clinical importance, as the number of women with epidural anesthesia whose second stages of labor were extended past one hour was not significantly increased. The study also mentioned second stage was terminated by the use of forceps for extraction of the infant, if the woman were permitted to continue to labor naturally, perhaps second stage would have been prolonged significantly. The study did find that the use of epidural anesthesia among low-risk women was associated with increases in the use of low forceps for delivery, increases in the use of oxytocic agents, increases in total overall costs, and increases in maternal comfort and cooperation. There thus appears to be a trade-off between the higher financial costs and the greater use of oxytocin and low forceps of an epidural delivery and the higher degrees of patient comfort and cooperation achieved using epidural anesthesia (Schussman et al., 1982).

Although previous studies (Chestnut et al., 1987) have reported contradictory data, considerable evidence suggests that epidural anesthesia is associated with longer labor and an increased risk of instrumental and cesarean delivery (Hueston, McClaflin, Mansfield, & Rudy, 1994). A longer first stage of labor in women who receive epidurals is believed to result from decreased uterine contractile forces, whereas prolongation of the second stage in these women is usually attributed a lack of sensory stimulation, which results in less efficient maternal pushing (Miller et al., 1993).

With the discovery of opiate receptors in the rat spinal cord and lower medulla (Pert et al., 1976, Atweh & Kuhar, 1977) the potential for pain control modulation at the level of the dorsal horn of the spinal cord was borne. Later in 1977, Yaksh and Rudy studied the direct spinal action of narcotics in the production of analgesia in the rat. They implanted rats with indwelling spinal

catheters to inject intrathecal opioids. To establish the fact that the observed effect was not unique to any single narcotic and to demonstrate the effect was dependent upon the relative concentration of the agonist in the spinal cord, dose response curves for a series of narcotics were obtained. The researchers found a relative potency of agents as follows: fentanyl > morphine > methadone > meperidine > codeine. Their experiments indicated that the analgesic effects of systemically administered narcotics is in part mediated by the pharmacological action of these compounds on the spinal cord (Yaksh & Rudy, 1977).

Following the discovery of intrathecal morphine as a potent analgesic in rats (Yaksh & Rudy, 1977) Wang et al. in 1979 set out to test it's effectiveness in patients with intractable cancer pain. Although their study was very small, consisting of only eight patients with back and leg pain from genitourinary malignancies, the authors made direct implications for use of intrathecal morphine in obstetric patients and post-operative pain.

Concurrent with the above research, a study was in progress to measure the effects of epidural morphine injections for severe acute and chronic pain. The study consisted of ten patients with ailments ranging from cancer to fractured ribs. They also tested the epidural morphine against epidural bupivacaine and found patients reported bupivacaine gave effective relief, but found it much less acceptable as compared to morphine. The study concluded that considerable pain relief was obtained with epidural morphine and that there were no signs of numbness, sympathetic block, such as postural hypotension or motor blockade, hence, patients could ambulate immediately post injection, pain free (Behar, Olshwang, Magora, & Davidson 1979).

Noting the successful results of intrathecal narcotic administration for chronic pain, a

study was conducted to evaluate intrathecal morphine as a sole analgesic in labor. The study consisted of twelve obstetric patients who received 1.5 mg of morphine intrathecally. Pain was abolished for all patients in the first stage of labor and in four of the patients for second stage. Pain was lessened in the second stage for the other three patients. It was also noticed that post-partum perineal pain was lessened for patients. The study did report side effects including itching of the face, nausea, vomiting, and frontal headache (Scott et al., 1980). The study made definite implications for the need for further study of all intrathecal opioids, not just morphine, in the field of obstetrics.

Another study of twenty obstetric patients was instituted to measure the analgesic effect of intrathecal morphine and to further evaluate maternal side effects. The study reported complete relief of labor pain 15-60 minutes after injection of morphine in all subjects. Seven of the subjects were given 1 mg of morphine intrathecally and thirteen were given 2 mg. Again, sympathetic blockade and motor blockade were not noted to be side effects. Also, all parturients except for three reported pain relief lasting throughout labor. Local infiltration of lidocaine was performed for episiotomy. The study did find that patients who received 2 mg of morphine required labor augmentation with oxytocin, and two of the thirteen required cesarean section. Maternal side effects, other than prolongation of labor, included drowsiness, nausea, and itching. Although labor augmentation was necessary in 61.5 percent of the parturients, the authors commented interpretation of the data should be guarded in view of the small number of subjects (Baraka et al., 1981).

In a study conducted by Abboud et al., (1984), it was found that both 0.5 mg and 1 mg of intrathecal morphine provided excellent pain relief throughout labor for both primiparous and

multiparous patients until distention of the perineum, and that 74% percent of these patients had normal progress of the first stage of labor and 59% percent had normal duration of second stage. On the other hand, 55% percent of the primiparas had prolonged second stage. The authors noted that these patients had not attended childbirth classes and often did not push effectively. This study also found a high incidence of side effects for both doses consisting of pruritus in 80% of patients, nausea or vomiting in 53% percent, urinary retention in 43% and drowsiness in 43%. These side effects were decreased by naloxone, which did not affect the degree of analgesia.

With the recent successes of epidural and intrathecally injected morphine for cancer patients, Husemeyer, O'Connor, and Davenport (1980) decided to measure the analgesic effectiveness of morphine applied epidurally during labor. The study revealed minimal relief of pain thirty minutes following epidural injection of 2 mg of morphine. The study was also confirmed by additional studies conducted in 1981 and again in 1984 (Abboud et al., 1984). Husemeyer et al. (1980) speculated that the reduced effectiveness of morphine could be due to the increased vascularity of the epidural space in pregnancy. The drug injected into the epidural space clears rapidly so that effective concentrations of morphine in the cerebrospinal fluid and spinal cord are not reached.

In response to the relative ineffectiveness of epidural morphine and the high incidence of side effects with morphine injected intrathecally, an epidural study was done to compare the analgesic effects of varying concentrations of bupivacaine alone and bupivacaine with fentanyl. Cohen, Tan, Albright, & Halpern (1987) found that the combination of both the local anesthetic and the opioid improved the quality of analgesia and its duration only in the groups with sub-therapeutic doses of bupivacaine 7.5 mg with 100 mg of fentanyl as compared to 22.5 mg of

bupivacaine alone. This study also commented that duration of labor was shorter although no statistical significance was reached. They suggested that the duration of labor can be shortened with opioids by the inhibition of maternal catecholamines, which can inhibit uterine contractions in labor without pain control. This is a separate issue from the sympathectomy produced by local anesthetics delivered to the spinal segments, thoracic one through four, which inhibit the cardiac accelerator neurons, causing hypotension and bradycardia.

Intermittent epidural technique needs re-dosing every one and one half to two hours or else the patient is uncomfortable. Continuous infusion for epidural analgesia in obstetrics was first described by Scott & Walker in 1963 (Datta, 1992). However, the technique did not gain popularity initially because of the lack of availability of proper instruments as well as local anesthetics. With the emergence of better mechanical infusion devices, as well as new local anesthetics, continuous infusion has indeed become the technique of choice for vaginal delivery.

Comparisons of intermittent injection technique with continuous epidural infusion (CEI) have found that CEI offers more stable depth of analgesia, lower blood concentrations of local anesthetics, and a lower incidence of hypotension due to decreased sympathetic blockade to name a few (Smedstad & Morrison, 1985).

In 1987, Chestnut et al. determined the influence of continuous epidural bupivacaine on the second stage of labor. Their study found that continuation of epidural infusion of local anesthetic beyond 8 cm dilation provides satisfactory analgesia, but prolongs the second stage of labor and increases the frequency of instrumental delivery in primiparous women. In 1988, Chestnut et al. modified the study and added fentanyl to comparing 0.125% and 0.0625% concentrations of bupivacaine. A follow up of this study, in 1994, used the same concentrations

of bupivacaine and also added fentanyl to the infusions. Results from both studies were more encouraging, concluding that using lower concentrations of bupivacaine (0.0625%) provided excellent analgesia throughout labor and significantly reduced the incidence of instrumental delivery (Stoddart, Nicholson, & Popham, 1994).

Intrathecal opioid techniques have been employed in an attempt to eliminate the problems associated with lumbar epidural. Combined spinal-epidural (CSE) is an innovative technique which combines these two techniques, and as previously mentioned offers the obstetric anesthesia provider several alternatives in the labor suite. The block can be extended or prolonged as needed. Also, a smaller-gauge needle is used for the spinal block, which may result in a lower incidence of postdural puncture headaches (Keller & Elliot, 1995). Refer to Figure 2.1, this demonstrates the insertion of the combined spinal epidural technique.

CSE also results in smaller total amounts of local anesthetics used. In a study that compared CSE analgesia with epidural alone for cesarean section, it was found that the dose of bupivacaine for a level T-4 block was about three times larger for the epidural alone than that required for CSE, and maternal and fetal blood sampling revealed a parallel difference in bupivacaine levels (Rawal, Schollin, & Wesstrom, 1988). This study also revealed less maternal hypotension in the CSE group. The precise mechanism by which relatively small volumes of local anesthetics in the epidural space can result in the pronounced elevation of the upper level of block with the CSE method is unknown (Keller & Elliot, 1995).

In 1994, the first study was accomplished to determine the safety and efficacy of the CSE technique in a large population (1022 subjects). The study compared the incidence of selected intrapartum complications associated with the induction of epidural and CSE labor analgesia.

The study found that both techniques afforded excellent labor analgesia and the incidence of minor complications after both techniques is low. Hypotension occurred at approximately the same frequency in both groups and complications of hypotension were about equal with 3.7% of the CSE cases and 4.6% of the epidural cases requiring ephedrine. The incidence of nausea and vomiting were also equal for both groups. The incidence of itching was significantly higher in the CSE group, but the authors still considered the incidence to be low. The study concluded that CSE is a safe and effective alternative to epidural, commenting that CSE is the preferred anesthetic for women in early labor, although both groups should be carefully monitored during induction of either labor analgesic technique (Norris et al., 1994).

D'Angelo et al., (1994) found that the duration of first and second stage of labor and the method of delivery were similar between two groups of CSE patients: one receiving epidural bupivacaine with intrathecal saline and the other intrathecal injection of sufentanil with epidural saline. The study also indicated that intrathecal sufentanil (10 μg) is associated with significantly better analgesia than epidural bupivacaine for the first 30 minutes after dosing. For additional requests for pain medication, epidural bupivacaine was given to both groups. It was found that significantly less bupivacaine was administered during first stage of labor, in the intrathecal sufentanil group. Side effects included pruritus for the sufentanil group readily treated with naloxone, and motor blockade for the epidural group. Nausea, bradycardia, hypotension, and use of ephedrine did not differ between the groups. There was also no difference in respiratory rate between the two groups. The authors concluded that intrathecal sufentanil confers no advantage over epidural bupivacaine other than decreased motor blockade.

Attempts have been made to increase the duration of analgesia produced by intrathecal

opioids. A variety of studies have been conducted using local anesthetics and even epinephrine. Many anesthesia providers add a small dose of bupivacaine to their intrathecal opioid of choice (Stacey, Watt, Kadim, & Morgan, 1993); (Campbell et al., 1995b). The dose used is not enough to produce a local anesthetic effect, but it is believed to prolong the duration of the opioid analgesic effects. The addition of 2.5 mg of bupivacaine to 10 μg of intrathecal sufentanil not only prolonged labor analgesia, but also significantly improved the analgesic profile without adverse maternal or fetal effects (Campbell, et al., 1995b).

Several researchers have demonstrated prolongation of local anesthetics with a variety of vasoconstrictors like, epinephrine and phenylephrine (Armstrong, Littlewood, & Chambers, 1983); (Leicht & Carlson, 1986); (Abouleish, 1987). A study by Grieco, Norris, Leighton, Arkoosh, Huffnagle, Honet, & Costello (1993), compared the prolongation of analgesia for intrathecal sufentanil with morphine and epinephrine. The results of the study revealed that only morphine extended analgesia significantly, but due to side effects associated with morphine the authors adamantly concluded their opinion that intrathecal morphine is not recommended for labor analgesia. Another study in 1993 used epinephrine to prolong the analgesic effects of sufentanil. This study also concluded that epinephrine does not significantly prolong the analgesic effects of intrathecal sufentanil (Camann et al., 1993). In a 1995 study to determine whether epinephrine will prolong the analgesic effects of intrathecal sufentanil 10 μg and bupivacaine 2.5 mg, in preliminary reports, the authors found that the addition of 0.2 mg of epinephrine to the above intrathecal combination significantly prolongs labor analgesia. The study also indicates that this very combination of intrathecal analgesia not only permits the majority of laboring patients to ambulate but also decreases the duration of the first stage of labor in primiparous patients

(Campbell et al., 1995a).

Summary

Pain control in labor entails a variety of trade-offs. First, for parenteral analgesia, there is the problem of respiratory depression and maternal sedation. These side effects can be frustrating to patient and provider. Many mothers desire to be an active participant in the labor process and report more satisfaction with epidural analgesia as compared to systemic analgesia in solving this issue (Robinson et al., 1980). As illustrated, epidural analgesia often is associated with other maternal side effects that are unwanted by patient and provider. Several methods have been implemented to combat these undesirable side effects, such as, continuous infusion, low-dose local anesthetic, and the addition of opioids to the epidural bolus of infusion. These methods have proven effective in minimizing the side effects of hypotension and motor blockade, but often require more patient monitoring by the anesthesia provider. In addition, controversy still exists pertaining to the effect of epidural analgesia on length of each stage of labor and the mode of delivery.

Intrathecal (ITA) and combined spinal-epidural techniques (CSE) hope to curtail the incidence of these side effects all together, and offer an alternative to busy practitioners for a method of pain control for parturients who would otherwise receive no analgesia. ITA and CSE techniques also may decrease the length of labor while allowing patients to continue to ambulate throughout first stage labor, which epidural technique does not allow at this time.

CHAPTER THREE

Methodology

Introduction

The design of this study is that of comparative descriptive. The data was collected by conducting a retrospective chart review of the last two hundred thirteen uncomplicated deliveries. The data collected was used to determine the influence of intrathecal (ITA) and combined spinal-epidural technique (CSE) on the length of first and second stage of labor and total labor as compared to patients who receive epidural (EPI), no regional, IV analgesia, or no analgesia at all (NR/IV/none).

A protocol for the intrathecal use of a combination of fentanyl, bupivacaine, and epinephrine is currently followed by the anesthesia department at a 70-bed Air Force hospital. Procedures are performed by each member of the anesthesia team. A 27 gauge Whitacre spinal needle is inserted through an 18 gauge Tuohy epidural needle. Fentanyl 25 μg and 2.5 mg of bupivacaine plus 200 μg epinephrine are injected into the spinal fluid at the L 2-3 to L 4-5 intravertebral space. All patients are monitored with electronic fetal monitoring. An obstetric nurse monitors vital signs, and the respiratory rate is recorded every 15 minutes until delivery, and then every one hour for the following 12 hours.

Patients receive analgesia during the intrapartum period upon request after discussion of the mode of analgesia between the patient, obstetric provider, and the anesthesia provider. Patient demographic data is contained in the perinatal record, the in-patient chart, and is collected at time of admission. Details of the labor and delivery are recorded during the

intrapartum period and at the time of delivery in the mothers' and infants' chart which becomes permanent medical record.

Charts were identified by reviewing recorded entries in the labor and delivery book which identified type of anesthesia, if any, received by each patient. Charts were then reviewed chronologically for the last fifty patients who received combined spinal-epidural, epidural, and intrathecal anesthesia. A complement of those parturients' charts who received intravenous or no analgesia during the same time period were also reviewed.

Sample

The study population was derived from a 70 bed Air Force Hospital with an obstetrical service which accommodates 100-120 deliveries per month. The subjects were chosen by meeting selection criteria so as to be considered low-risk and homogeneous. The study sample consisted of four groups based on the type of analgesia they received in labor. Group I consisted of the last fifty patients who met the selection criteria and received combined spinal-epidural (CSE). Group II included the last fifty patients within the same time frame who met the selection criteria and received epidural analgesia only (EPI). Group III consisted of the last fifty patients meeting the selection criteria who received intrathecal (ITA) injection only. Finally, Group IV involved the last fifty patients who did not receive regional anesthesia (NR), only intravenous analgesia or no analgesia at all (NR/IV/none). The total study sample consisted of 213 subjects, n=213. Using the method of Kraemer & Thiemann (1987) at a .05 significance level, 80% power analysis, it was determined that 50 subjects were needed in each group for this study. This produces a .40 critical effect size for a total of 200 subjects. Over sampling with 213 subjects will occurred in this study to attempt to offset a potential loss of subjects.

Selection Criteria

In order to avoid a statistically significant difference between the groups characteristics as to demographic data, gestational age, and birth weight, the following selection criteria were established. Singleton pregnancy with no complicating medical or obstetric problems, ASA I or II, gestational age at delivery of 35.5-42 weeks, vertex presentation, parity less than five, age 17 to 39 years old, and birth weight between 5 and 10 pounds (2275-4550 grams). Cervical dilation at the time of injection was noted when the data was collected. Pregnancies which resulted in cesarean section were included in the study to determine the relationship between anesthesia and incidence of cesarean section.

From the four groups listed above, subsets were created according to parity. For instance, for Group I: Primiparas (P) with CSE and Multiparas (M) with CSE. Group II: (P) with EPI and (M) with EPI. Group III: (P) with ITA and (M) with ITA. Group IV: (P) with NR/IV/none and (M) with NR/IV/none.

The subjects in this study presumably came from relatively similar socioeconomic backgrounds consisting of either active duty personnel, dependents of active duty, or retired military personnel. Access to care was an important issue in this case. Subjects have had access to prenatal care and have the advantage of having been offered a child birth preparation course which was free of charge. Patients who deliver at military hospitals paid a flat rate charge of $8.00 per day, easing financial burden of childbirth and eliminating concerns of expensive intrapartum pain management.

Table 2.

Record Keeping Table

ID #	ag	rce	wt	ht	ge	dil	L1	L2	L3	An	del	A1	A5	bw .	AP	dg

Key: ID# = patient's hospital number
ag = age in years
rce = race, see below
wt = weight of parturient in kilograms
ht = height in centimeters
ge = gestational age in weeks
dil = cervical dilation at time of injection in centimeters
L1 = Length of first stage of labor in minutes
L2 = Length of second stage of labor in minutes
L3 = Length of total labor (sum of L-1 and L-2)
An = Type of anesthesia received, see below for coding
del = Type of delivery, see below for coding
A1 = First minute apgar score (number from zero to ten)
A5 = Second minute apgar score
bw = birth weight in grams
AP = Anesthesia provider (to note any variance in technique between providers)
dg = to ensure study subjects are receiving same drug combination of ITA

Coding:

Race

1. Caucasian
2. Black
3. Hispanic
4. Asian
5. Other

Type of anesthesia

1. CSE
2. EPI
3. No Regional

Type of delivery

1. Vaginal
2. Instrument, forceps or vacuum
3. Cesarean section

Medication (drug)

1. Standard combination.
2. Not standard, write in medication combination given.

Instrumentation

The data was collected during chart review using a simple horizontal record keeping table. The targeted data was listed in columns across the table for each subject listed in sequence vertically (see Table 2). Data was encoded numerically at the time of collection to facilitate computer data entry during the analysis phase of the study.

Research Design

The study is a comparative descriptive design to examine and describe the difference between intrathecal and epidural analgesia. The comparison was accomplished by a retrospective chart review of the factors associated with CSE, EPI, and ITA analgesia, namely, length of each stage of labor, in a low-risk obstetrical population. Stage one labor was modified for the subjects who received regional analgesia. In order to measure how different modes of analgesia affect the length of stage one labor, it was calculated as time elapsed from time of injection until complete cervical dilation. Stage one for the subjects who did not receive regional analgesia was determined by documentation on the chart by the obstetric provider.

For the following illustration of the hypotheses, F denotes first stage, S denotes second stage, and T denotes total labor, or the sum of the first two stages. The numbers, 1, 2, and 3 signify from which anesthesia group the subjects are derived, for example: 1 = CSE, 2 = EPI, 3 = ITA and 4 = NR/IV/none. And $\approx$ signifies congruent, of no significant difference. Note for ready comprehension, the hypotheses illustrated here are not presented in the null as in Chapter One.

Hypothesis 1: F1 and F3 < F2 and F4

F1= mean length of 1st stage labor for CSE

F2= mean length of 1st stage labor for EPI

F3= mean length of 1st stage labor for ITA

F4= mean length of 1st stage labor for NR/IV/none

Hypothesis 2: S1 and S3 < S2, S1 and S3 ≈ S4

S1= mean length of 2nd stage labor for CSE

S2= mean length of 2nd stage labor for EPI

S3= mean length of 2nd stage labor for ITA

S4= mean length of 2nd stage labor for NR/IV/none

Hypothesis 3: T1 and T3 < T2, T1 and T3 ≈ T4

T1= mean length of total labor for CSE

T2= mean length of total labor for EPI

T3= mean length of total labor for ITA

T4= mean length of total labor for NR/IV/none

Statistical Analysis

Descriptive statistics and frequencies were performed to describe demographic data such as age, race, height, weight, gestational age, gravity, parity and infant birth weight. Analysis of variance (ANOVA) was performed for the mean length of each stage of labor and how anesthesia affects each stage of labor. Stage one labor for groups 1-3 was calculated as time complete minus

time of injection. The mean of stage one for each group was then compared using ANOVA. Multiple analysis of variance (MANOVA) was conducted to compare how age, height, weight, gestational age, parity, infant weight, use of oxytocin, type of delivery, and type of anesthesia (dose and medication given), affect length of each stage of labor. A $p < 0.05$ is significant to establish a 95% confidence interval. Specific data pertaining to length of each stage of labor will be expressed as mean +/- the standard deviation and additionally analyzed using Tukey HSD (honestly significant difference) post hoc test.

Limitations

Theoretical limitations of this study encompass the multitude of variables that affect the length of each stage of labor. Although this study was retrospective in an attempt to decrease the number of extraneous variables, it is difficult to account for variables that affect the length of labor that are not totally apparent in conducting a chart review.

Methodological limitations of this study are more apparent and surround the sample of subjects selected for study. The study sample is a sample of convenience, in a relatively unique populous of those who qualify for treatment at a military health care facility. The results of this study do not have universal application, especially to civilian care services. Also, randomization occurs only by where the subject falls in the retrospective review, while meeting specific inclusion criteria. This is not true randomization.

Modifying the length of stage one labor for those who receive regional analgesia will inherently make length of stage one shorter as compared to those who do not receive regional analgesia because time of first stage is not measured before injection of regional analgesia. To off set this rate of labor in centimeters per hour before and after injection will be measured to further

analyze how regional analgesia affects length of stage one labor, and to compare intrathecal and epidural methods.

Finally, it was unpredictable how many of the combined spinal-epidural (CSE) patients had received additional epidural local anesthetic, since it is a combined technique, before the chart review was conducted. The possibility of subsequent intrapartum problems of those who received both methods of analgesia would seem to approximate those of patients who received epidural only. Even thought the CSE group had the advantage of opioid analgesic effects, there exists the possibility they may have received doses of local anesthetics in similar amounts to those who received epidural analgesia only.

Summary

This study was conducted using a retrospective chart review to determine the influence of CSE and ITA on the length of first and second stage of labor and total labor as compared epidural and no regional analgesia. The study consisted of a relatively homogeneous, low risk obstetric sample since inclusion criteria were established for subjects entered into the study. The sample was derived from a small Air Force Medical Treatment facility so generalizations will be limited, but larger studies can be modeled after this small military sample.

CHAPTER FOUR

Analysis of Data

Introduction

Two-hundred thirteen charts were reviewed for this study to determine the effect of intrathecal narcotic on length of labor as compared to epidural and no regional analgesia. Of the charts reviewed 76 were in the combined spinal epidural (CSE) group, 41 in the epidural (EPI) group, 49 in the intrathecal (ITA) group, and 47 received no regional anesthesia (NR/IV/None). The original goal of the study was to obtain 50 subjects for each group, but because data was collected in two phases: chart identification and chart review, subjects were sorted into the correct study group according to the chart review. Many subjects changed from the EPI and ITA groups to the CSE group, thus the CSE group has the greatest number of subjects.

Characteristics of the Study Sample

For data analysis, the groups were labelled numerically: (1) CSE, (2) EPI (3) ITA and (4) NR/IV/None. The groups were similar with respect to maternal age, height, weight, gestation, and cervical dilation (See Table 3). The CSE group had the majority of primiparas, while the NR/IV/None group had the majority of multiparas. The EPI and ITA groups were more similar in respect to number of primiparas and multiparas in each group. Analysis of data according to parity follows later in this chapter. The ITA and NR/IV/None groups were more similar in their incidence of spontaneous vaginal delivery, 89.8% (44/49) and 95.7% (45/47) respectively, along with a low incidence of instrumental delivery and cesarean section (See Table 3). The epidural group had the least subjects deliver vaginally, 53.7%, (22/41) with a cesarean section rate of 31.7%, (13/41). Only 6 subjects (14.6%) in the EPI group required instruments for delivery. The

CSE group had only 61.8% (47/76) of the subjects deliver vaginally, with virtually an even split in the incidence of instrumental (18.4%, which is 14 of 76) and cesarean section (19.7%, which is 15 of 76) delivery. Analysis of data according to mode of delivery related to method of analgesia follows later in this chapter. The presence of VBAC subjects, that is, parturients who attempt vaginal birth after cesarean section with their previous deliveries, is greatest in the epidural group, and least in the no regional anesthesia group.

Table 3.

Sample Characteristics

	CSE	EPI	ITA	NR/IV/None
	N=76	*N=41*	*N=49*	*N=47*
Age (years)	24.6	26.0	24.8	24.9
Height (cm)	64.9	63.9	64.8	64.9
Weight (kg)	83.5	83.8	80.4	78.3
Gestation (wk)	39.7	39.6	39.6	39.6
Primipara	52 (68.4%)	20 (48.8%)	22 (44.9%)	15 (31.9%)
Multipara	24 (31.6%)	21 (51.2%)	27 (55.1%)	32 (68.0%)
Dilation (cm)	4.45	4.34	5.53	N/A
SVD	47 (61.8%)	22 (53.7%)	44 (89.8%)	45 (95.7%)
Instrument	14 (18.4%)	6 (14.6%)	3 (6.1%)	1 (2.1%)
C-Section	15 (19.7%)	13 (31.7%)	2 (4.1%)	1 (2.1%)
VBAC	8 (10.8%)	9 (22.5%)	3 (6.5%)	2 (4.3%)

Sample characteristics with respect to race are described in Table 4. Caucasians made up 64.8% (138/213) of the sample, while there were 26.3% (56/ 213) Black, 4.7% (10/213)

Hispanic and 4.2% (9/213) Asian. Race was represented in each of the study group as described in Table 5.

Table 4.

Demographics of Sample Based on Race

	Frequency	Percent	Cumulative Percent
Caucasian	138	64.8	64.8
Black	56	26.3	91.1
Hispanic	10	4.7	95.8
Asian	9	4.2	100.0
TOTALS	213	100.0	100.0

Table 5.

Race Represented in Each Study Group

RACE	CSE	EPI	ITA	NR/IV/None
Caucasian	59.2%	61.0%	63.3%	78.7%
Black	31.6%	31.7%	24.5%	14.9%
Hispanic	6.6%	2.4%	4.1%	4.3%
Asian	2.6%	4.9%	8.2%	2.1%

Calculation of Mean Length of Each Stage of Labor

Mean length of each stage labor is represented in Table 6. Cases included were 85.4% (182/213) of the total sample. Cesarean section cases were excluded. Cases excluded were 31 of 213, 14.6% of the sample group. Thus, the cesarean section rate for this study 14.6%. Length of first stage for groups 1-3 was calculated as time of injection until time of complete cervical

dilation (10 cm). Length of first stage labor for group 4 was taken from the labor record, and represents time calculated from onset of active labor until time complete, as documented by the obstetric provider. Length of second stage was taken from the labor record for all groups. Length of total labor was calculated for groups 1-3 by adding together time after injection and stage two. Length of total labor for group 4 was calculated as length of stage one plus length of stage two. All results are in minutes.

Table 6.

Mean Length of Each Stage of Labor in Minutes for Groups 1-4

Type of Anesthesia Received	Length of Stage One (min)	Length of Stage Two (min)	Length of Total Labor (min)
Combined Spinal Epidural N=61	Mean= 195.74 SD=123.30	Mean= 74.84 SD= 60.76	Mean= 270.57 SD= 138.96
Epidural N=27	Mean= 204.33 SD= 182.51	Mean= 62.89 SD= 42.78	Mean= 267.22 SD= 206.15
Intrathecal N=47	Mean= 83.60 SD= 69.39	Mean= 44.28 SD= 45.22	Mean= 127.87 SD= 74.84
NR/IV/None N=47	Mean= 320.47 SD= 153.26	Mean= 25.83 SD= 26.48	Mean= 346.30 SD= 162.49
Total N=182	Mean= 200.26 SD= 155.92	Mean= 52.52 SD= 50.71	Mean= 252.78 SD= 164.63

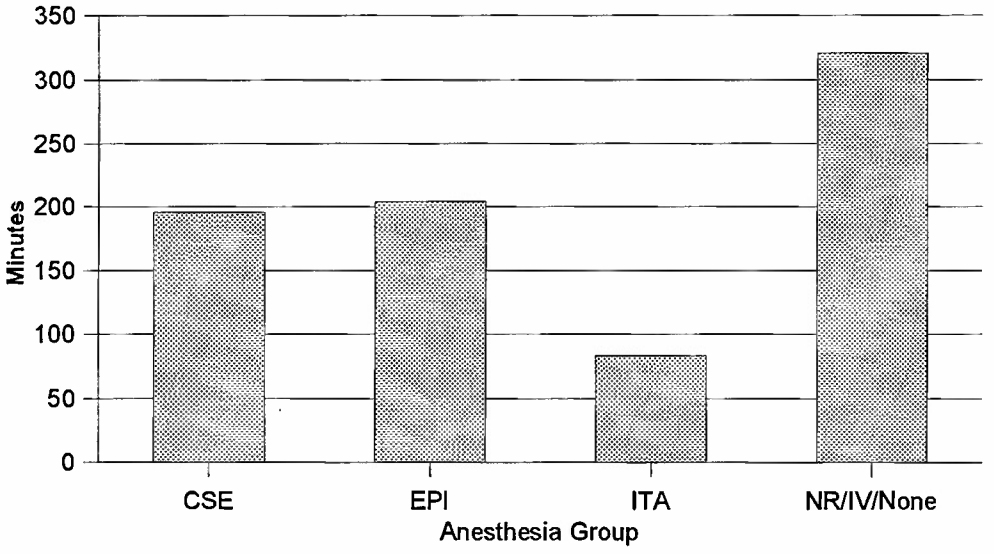
First Stage Labor

Analysis of the Variance (ANOVA) was performed between groups in terms of mean length of each stage of labor. To establish a 95% confidence interval, the alpha ($\propto$) was set at .05.

The F significance of F=.000 was determined among all groups for each stage of labor, no significance was reached within groups. A post hoc Tukey HSD test was performed showing a significant difference ($p \leq .001$) between length of stage one for all groups except CSE and EPI. Length of first stage was significantly shorter for ITA, EPI, and CSE as compared to NR/IV/None. Length of first stage was significantly shorter for ITA as compared to CSE and EPI. There were no significant differences in length of stage one between CSE and EPI groups. Mean length of first stage labor in minutes is represented by Figure 1. As determined above there is a significant difference among groups except the CSE and EPI group.

Figure 1.

Mean Length in Minutes of Stage One Labor for Groups 1-4

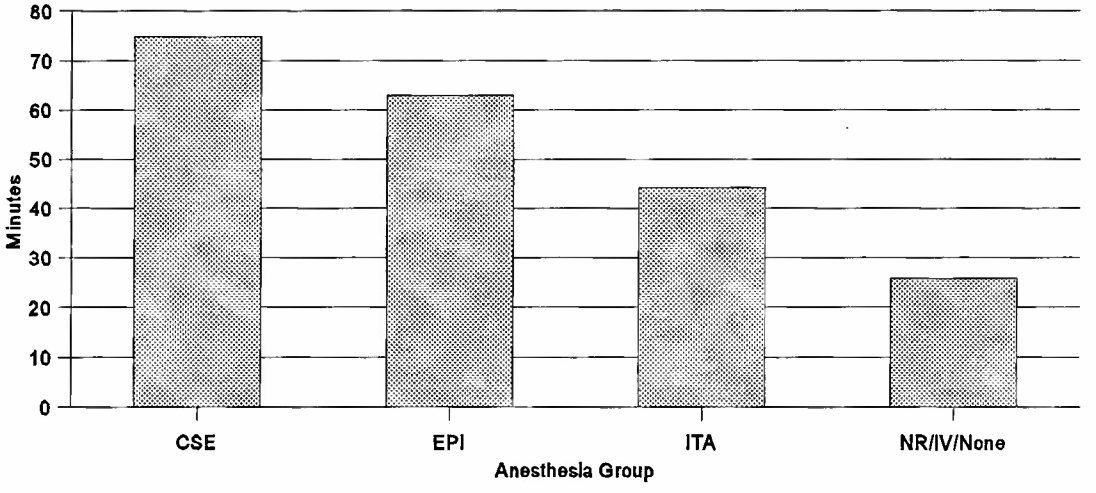


Note: *Length of stage one is calculated for groups 1-3 as time elapsed since injection until time of complete cervical dilation.

Significance of p=.000 was reached between the ITA and NR/IV/None groups. Significance of p= .001 was reached between ITA and EPI groups. Significance of p=.000 was reached between CSE and ITA, NR/IV/None groups.

Figure 2.

Mean Length in Minutes of Stage Two Labor for Groups 1-4



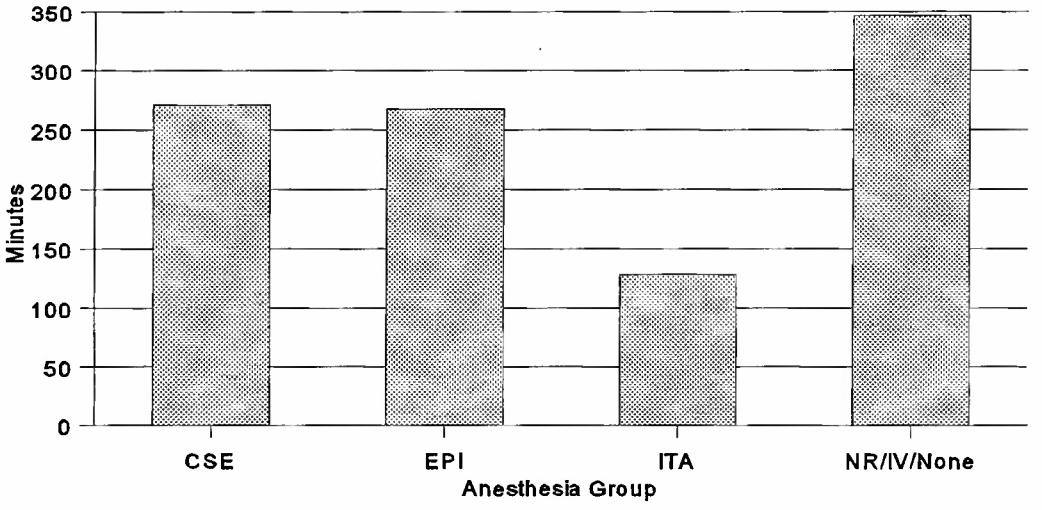
Second Stage Labor

For stage two, post hoc Tukey HSD test revealed that second stage was significantly prolonged in the CSE group as compared to ITA (p= .005), and NR/IV/None (p= .000). Also, that stage two for the EPI group was significantly prolonged as compared to the NR/IV/None group only (p= .006). As shown in Table 6 length of stage two was shortest for the NR/IV/None group. Therefore length of second stage was significantly longer for CSE as compared to ITA and NR/IV/None, and there were no significant differences in length of second stage between CSE and EPI, EPI and ITA, ITA and NR/IV/None.

Length of second stage labor in minutes is represented by Figure 2. As determined above NR/IV/None group had a significantly shorter length of second stage labor as compared to CSE (p=.000) and EPI (p=.006). There was no significance reached in length of second stage labor between the NR/IV/None and ITA groups. There was also no significance reached between the CSE and EPI groups.

Figure 3.

Mean Length in Minutes of Total Labor for Groups 1-4



Note: *Length of total labor is calculated for groups 1-3 as time elapsed since injection plus length of stage two.

Total Labor

Using the data from Table 6, post hoc Tukey HSD was performed to measure where significant differences occurred for mean length of total labor. There was no significance reached between the CSE and EPI, CSE and NR/IV/None, EPI and NR/IV/None groups. Figure 3

represents the mean length of total labor for each group 1-4. Significance was reached (p=.000) between the ITA and CSE, EPI, NR/IV/None groups. Therefore, length of total labor is significantly shorter for the ITA group as compared to the remaining three groups.

Mean Dilation at Time of Injection for Groups 1-3

Dilation at time of injection was recorded for each group. Cross-tabulation of the mean cervical dilation at the time of injection for each group was performed. Refer to Table 7 and Figure 4. A bell shaped curve was obtained demonstrating the distribution of mean cervical dilation at the time of injection for each anesthetic group. As depicted by the table and the graph, the majority of patients were injected at 4-5cm dilated. The mean dilation at time of injection (all groups) was 4.76. No patients were injected after 9cm or during second stage. There are no data representing the NR/IV/None group since they did not receive regional analgesia.

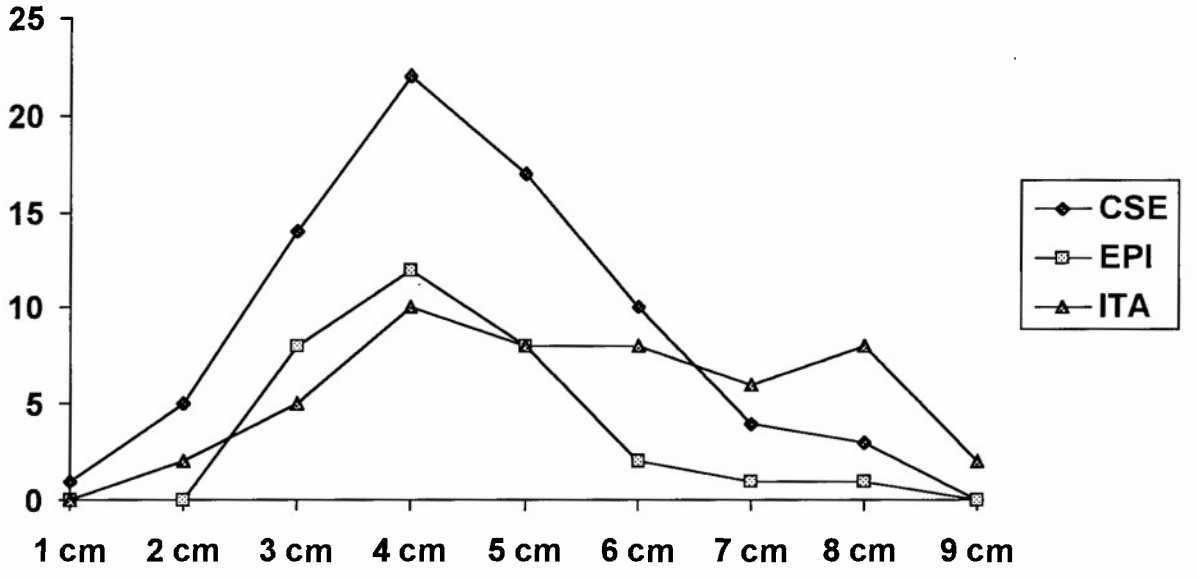
Table 7.

Dilation in Centimeters at Time of Injection for Each Group 1-3

Type of Anesthesia Received			
Dilation	CSE	EPI	ITA
1.0	1	0	0
2.0	5	0	2
3.0	14	8	5
4.0	22	12	10
5.0	17	8	8
6.0	10	2	8
7.0	4	1	6
8.0	3	1	8
9.0	0	0	2

Figure 4.

Mean Centimeter Dilation at Time of Injection for Each Group 1-3

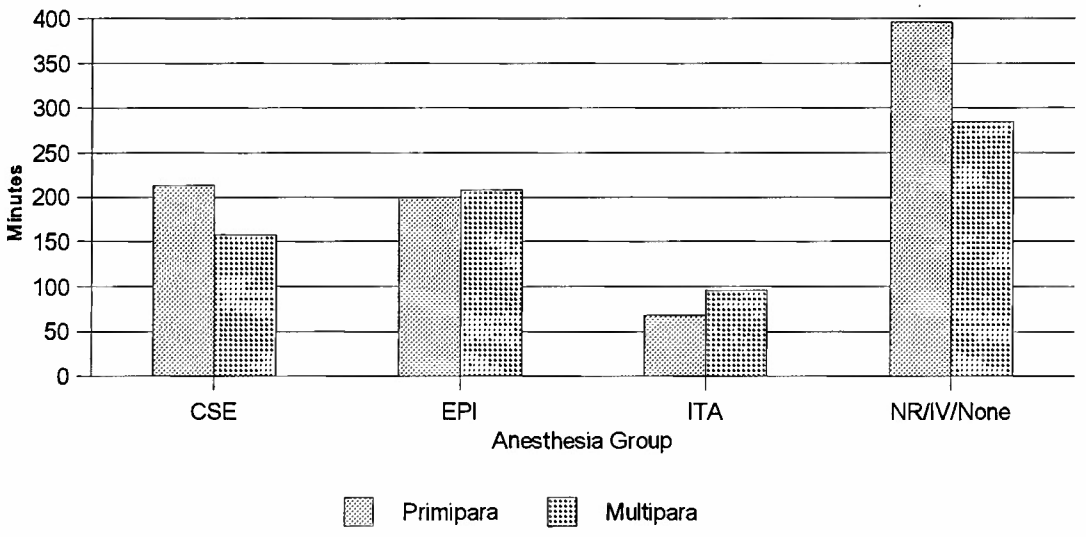


Primiparas: Figure 5 represents the length of stage one labor for each group 1-4 according to parity. ANOVA revealed a significant difference between all groups for primiparas. Post hoc Tukey test shows significant differences between CSE and ITA (p=.000), CSE and NR/IV/None (p=.000); EPI and ITA (p=.005), EPI and NR/IV/None (p=.000); there was no significance between length of first stage labor for CSE and EPI groups for primipara. ITA group had significant differences with CSE and NR (p=.000) and with EPI (p=.005). NR/IV/None group had significant differences with the other three groups (p=.000).

Multiparas: ANOVA for multiparas showed a significant difference between all groups. Post hoc Tukey test revealed significant differences between CSE and NR/IV/None (p=.015),

ITA and NR/IV/None (p=.000) only. Stage one for multiparas was significantly longer for the NR/IV/None group as compared to CSE and ITA. No significant differences were found for length of multipara first stage between CSE and ITA, EPI and ITA, EPI and NR/IV/None. Figure 5.

Length in Minutes of First Stage Labor According to Parity for Groups 1-4



Note: *Length of stage one is calculated for groups 1-3 as time elapsed since injection until time of complete cervical dilation.

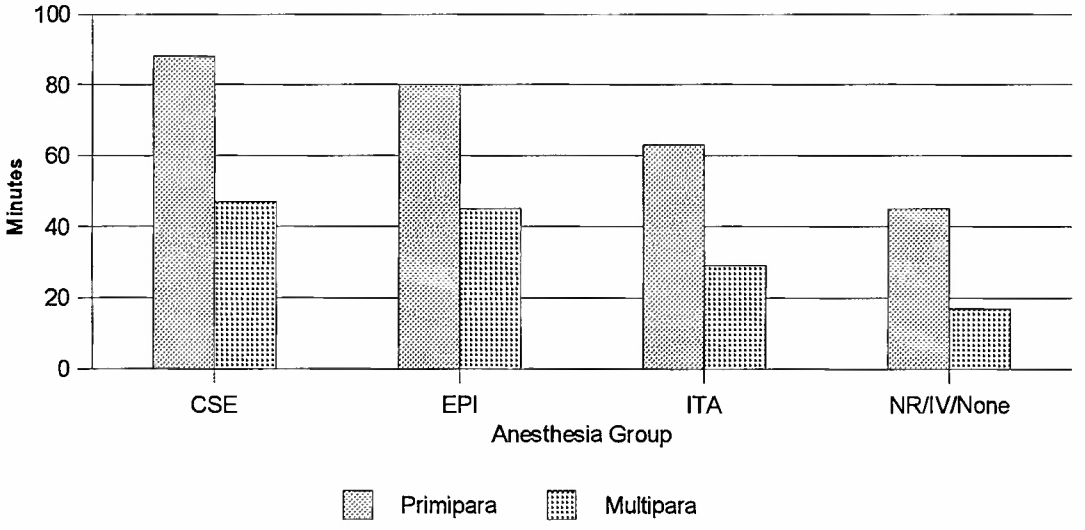
No significance was reached for length of first stage labor between primiparas and multiparas in the CSE, EPI, or ITA groups. Significance was reached between primiparas and multiparas for the NR/IV/None group (p= .019). A significant difference is expected in length of first stage labor between primparas and multiparas, not seen with groups 1-3. Therefore, regional analgesia affects primaparas most significantly as compared to multiparas.

Stage Two According to Parity

Primipara: Figure 6 represents the length of stage two labor for each group 1-4 according to parity. ANOVA revealed significant differences between all groups for primiparas. Post Hoc Tukey test shows significance for primipara in length of stage two labor for CSE and NR/IV/None group only (p=.047). All other groups did not reach significance. That is, the only significant difference in length of second stage labor between anesthesia groups for primiparas is between CSE and NR/IV/None. CSE has significantly longer second stage as compared to NR/IV/None group. Other groups do not significantly differ in length of second stage for primiparas.

Figure 6.

Length in Minutes of Second Stage Labor According to Parity for Groups 1-4



Multiparas: After ANOVA showed significance between groups, a post hoc Tukey test for multiparas revealed significant differences between CSE and NR/IV/None group only (p=.012). The length of stage two was significantly less for multiparas for the NR/IV/None group as compared to the CSE group. No significance was determined between any other groups.

Length in Minutes of Total Labor According to Parity for Groups 1-4

Figure 7 represents the length of total labor for each group 1-4 according to parity. ANOVA found significant differences of mean length of total labor between groups for primiparas and multiparas.

Primiparas: Post hoc Tukey test for primiparas shows significance for all groups with p<.005 except CSE and EPI groups. That is, CSE and EPI have no significant difference in length of total labor for primipara as compared to each other. Also, length of total labor is significantly shorter for primipara in the ITA group as compared to the remaining groups: CSE (p=.000), EPI (p=.005) and NR/IV/None (p=.000). Length of total labor for the NR/IV/None group is significantly greater than all other groups: CSE (p=.002), EPI (p= .005), and ITA (p=.000).

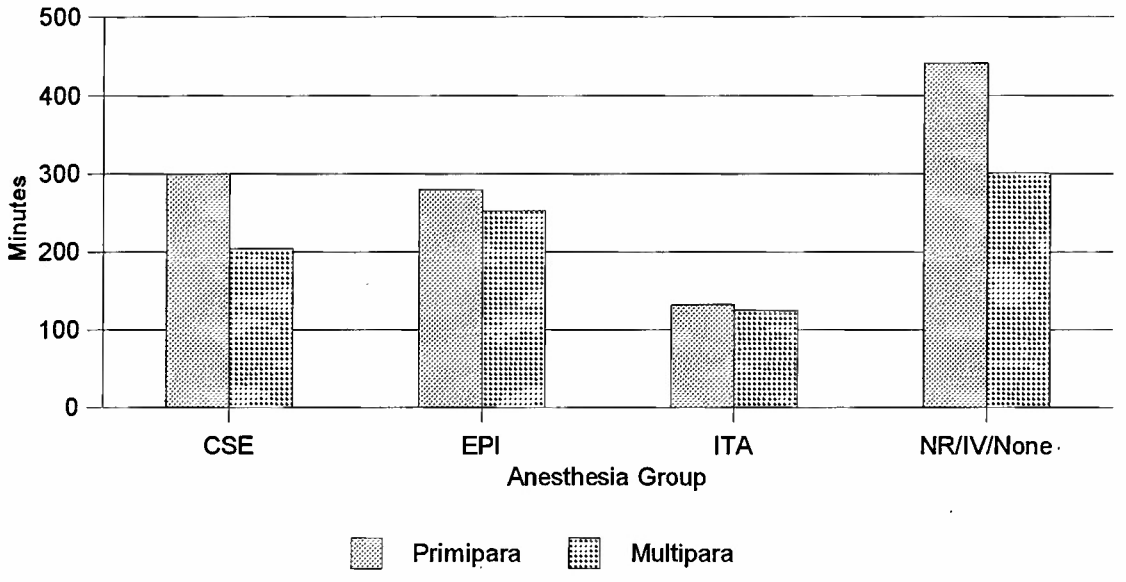
Multiparas: The Post hoc Tukey test for multiparas revealed no significant differences in length of total labor for all groups except for ITA and NR/IV/None (p=.000). Multiparas have no significant difference in length of total labor if they received CSE, ITA or EPI analgesia, but ITA significantly shortened length of total labor as compared to the NR/IV/None group.

There is a significant difference between primiparas and multiparas length of total labor in the CSE and NR/IV/None groups only. This is expected. No significant difference exists for the EPI and ITA groups, length total labor for primiparas and multiparas is more equal. Therefore

EPI and ITA groups have a greater effect on decreasing length of primipara total labor.

Figure 7.

Length in Minutes of Total Labor According to Parity for Groups 1-4



Note: *Total labor was calculated for groups 1-3 as time elapsed since injection plus the length of stage two.

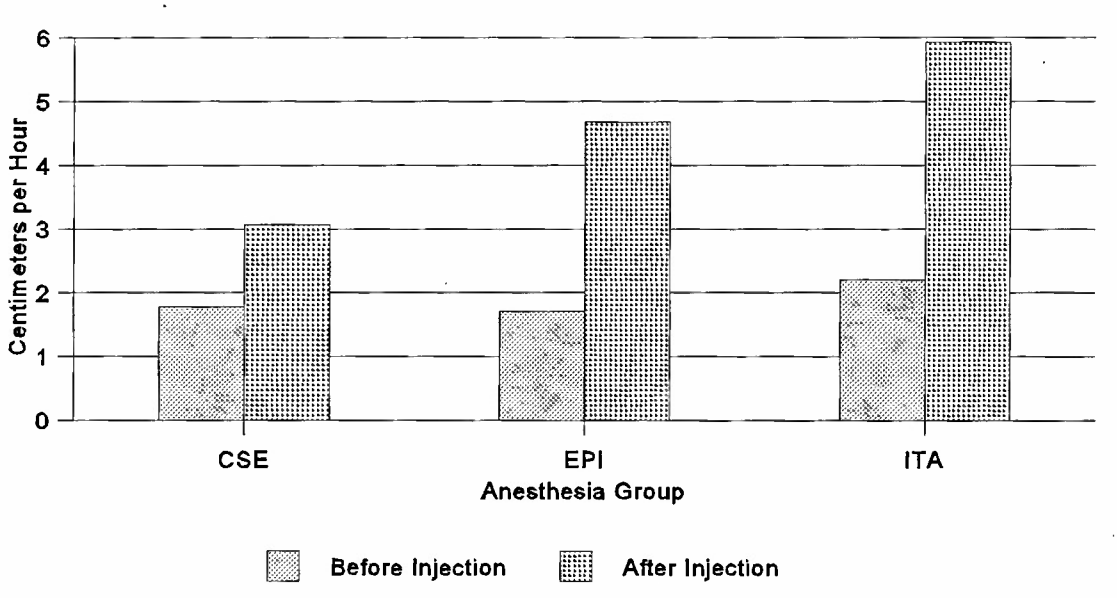
Rate of First Stage Labor Before Injection of Regional Analgesia

The average rate of first stage labor in centimeters per hour, before and after injection, was calculated for parturients who received each method of regional analgesia. Calculation was performed for rate of first stage labor before injection by dividing cervical dilation at time injected by time elaplsed, in hours, before injection. The average rate of first stage labor before injection for each anesthetic group was as follows: CSE= 1.78 cm/hr, EPI= 1.71 cm/hr, and ITA= 2.20 cm/hr (Refer to Figure 8). Mean of Groups 1-3 is 1.8 cm/hr. There is no statistical significance between rate of labor before injection between groups 1-3. For example, all subjects were

progressing at the same rate of labor in stage one before injection. Accordingly, there is no rate of labor before injection for the NR/IV/None group since no injection was given. Rate of first stage labor for the NR/IV/None group can be calculated for first stage by dividing mean length of first stage in hours by 10 centimeters. Average rate of labor for comparison in the NR/IV/None group = 2.5 cm/hr, which is not significantly different from rate of labor before injection for the anesthetic groups.

Figure 8.

Rate in Centimeters per Hour of Stage One Before and After Injection



Rate of First Stage Labor After Injection of Regional Analgesia

Rate of first stage labor after injection was calculated by taking the dilation in centimeters remaining after injection before complete dilation and dividing by time elapsed, in hours, after injection. The calculated average rate of labor (in centimeters per hour) for regional analgesia groups after injection was as follows: CSE= 3.07, EPI= 4.68, and ITA= 5.93. Significance was found (p= .028) between CSE and ITA groups. Rate of first stage labor in the ITA group is significantly faster than in the CSE group. There are no significant differences between the CSE and EPI, and ITA and EPI. Rate of first stage labor before injection was significantly longer than after injection for all three groups (p= .000). Figure 8 depicts these significant differences. Recall, the average rate of first stage labor for the NR/IV/None group was 2.50cm/hour. Rate of labor after injection is significantly faster for all three groups as compared to the average rate of first stage labor for the NR/IV/None group (p=.000).

Length of Each Stage of Labor According to Oxytocin Administration

Statistical analysis was performed to determine the influence of oxytocin administration on length of labor. The incidence of oxytocin for each anesthetic group is described in Table 8. The table includes cases that had cesarean section.

Table 8.

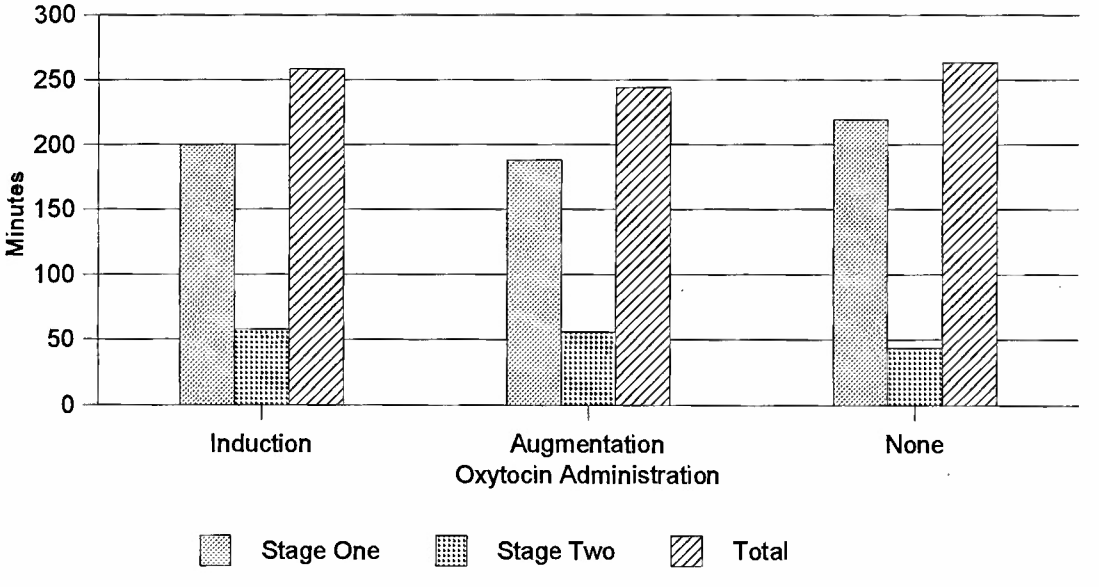
Oxytocin Administration for Groups 1-4

Oxytocin	CSE	EPI	ITA	NR/IV/None	Total
Induction	18 (23.7%)	13 (31.7%)	9 (18.4%)	4 (8.5%)	44 (20.7%)
Augment	44 (57.9%)	20 (48.8%)	24 (49.0%)	14 (29.8%)	102 (47.9%)
Total (Oxy)	62 (81.6%)	33 (80.5%)	33 (67.4%)	18 (38.3%)	146 (68.5%)
None	14 (18.4%)	8 (19.5%)	16 (32.7%)	29 (61.7%)	67 (31.5%)
Total	76	41	49	47	213

It was determined that the administration of oxytocin, whether for induction or augmentation did not effect length of labor as compared to those subjects who did not receive oxytocin. Refer to Figure 9. There was no significant difference found in length of first stage, second stage or total labor between those who received oxytocin and those subjects who did not.

Figure 9.

Mean Length of Each Stage of Labor According to Oxytocin Administration



Incidence of Instrumental Delivery and Cesarean Section with Regional Analgesia

The type of deliveries for groups 1-4 is described in Table 9. The EPI and CSE groups had the highest incidence of instrumental delivery and cesarean section. The ITA group more resembled the NR/IV/None group. Refer to Figure 10. There was no significance found between the EPI and CSE groups or between the ITA and NR/IV/None group. Significance was found between the CSE and ITA groups (p= .003) and between the CSE and NR/IV/None group (p=.000). Significance was also found between the EPI and ITA groups (p= .000) and EPI and NR/IV/None groups (p= .000) for incidence of instrumental delivery and cesarean section.

Table 9.

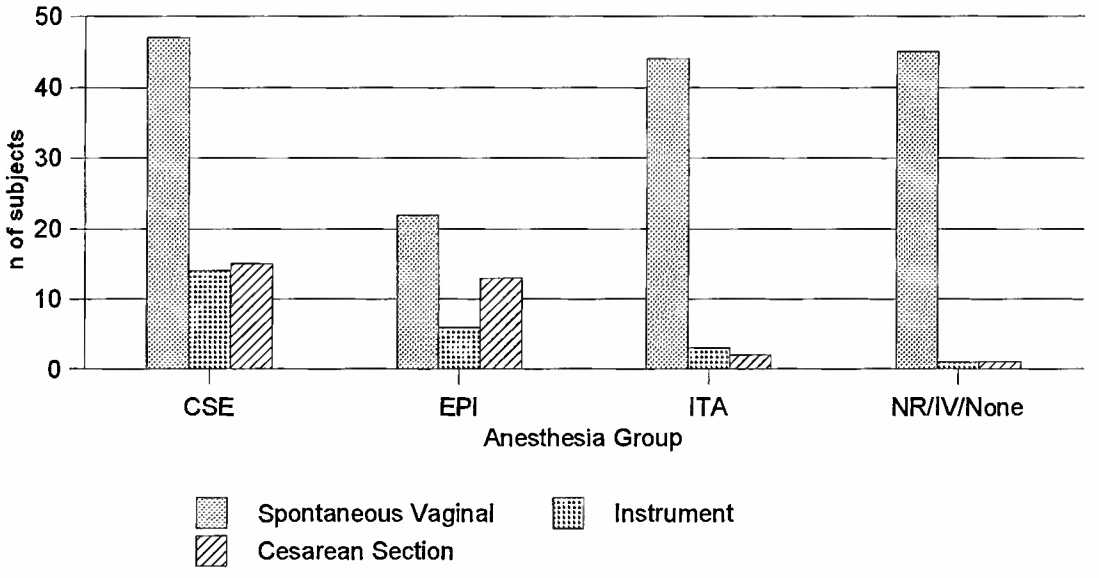
Frequency of Delivery Type by Anesthesia Type

Type of Delivery	CSE	EPI	ITA	NR/IV/None	Totals
SVD	47 (61.8%)	22 (53.7%)	44 (89.8%)	45 (95.7%)	158
Instrument	14 (11.8%)	6 (14.6%)	3 (6.1%)	1 (2.1%)	25
C-Section	15 (19.7%)	13 (31.7%)	2 (4.1%)	1(2.1%)	30
Total	76	41	49	47	213

For incidence of spontaneous vaginal delivery significance was found between the EPI group and the remaining three groups (CSE, ITA, and NR/IV/None). That is, the incidence of vaginal delivery for the EPI group was significantly lower as compared to the other three groups.

Figure 10.

Frequency of Delivery Type by Anesthesia Type



Infant Birth Weight

Birth weight for each infant was divided into three groups as follows: Group 1 = 2377 to 3000 gms, Group 2 = 3001 to 4000 gms and Group 3 = 4001 to 4848 gms. Refer to Table 6 for distribution of birth weight groups among anesthetic groups. The majority of infants were in group 2, weighing 3001 to 4000 gms. Refer to Table 11 for distribution of birth weight groups according to type of delivery.

Table 10.

Infant Birth Weight and Type of Anesthesia

	Type of Anesthesia				
Birth Weight	CSE	EPI	ITA	NR/IV/None	Total
Group 1	9 (12%)	4 (9.7%)	5 (10.6%)	7 (15.6%)	25
Group 2	51 (68%)	32 (78%)	39 (82.9%)	32 (71.1%)	154
Group 3	15 (20%)	5 (12.2%)	3 (6.4%)	6 (13.3%)	29
Totals	75	41	47	45	208*

*Data missing for five subjects

As the table shows, group 3, infants weighing over 4001 gms have a high incidence of cesarean section. Of the 31 cesarean sections in this study, 29 had known birth weights. Of the cesarean sections, 65.5% (19/29), were for infants with birth weight in group 2 and 34.5% (10/29) in group 3. According to the data available, no cesarean sections were done for birth weight in group 1. Note according to Table 10, the CSE group has the highest number of group 3 infants, 20% (15/75)of the CSE sample. ANOVA was performed to determine the effect of infant birth weight and its influence on length of each stage of labor. Post hoc significance using Tukey's HSD was determined for group 3. Group 3 infants (greater than 4000 gms) prolonged total labor significantly (p=.036), but not first or second stage individually. There was no significance found for any birth weight group on stage one or stage two labor.

Table 11.

Infant Birth Weight and Type of Delivery

	Type of Delivery			
Birth Weight	SVD	Instrument	C-Section	Total
Group 1	22 (14.3%)	3 (1.2%)	0 (0%)	25
Group 2	116 (75.3%)	19 (7.6%)	19 (65.5%)	154
Group 3	16 (10.4%)	3 (1.2%)	10 (34.5%)	29
Total	154	25	29	208*

*Data missing for five subjects

The Effect of Obstetric Provider on Length of Labor

There were ten obstetric providers that managed labor for the subjects in this sample. Providers were Physicians (MD) or Nurse Midwives (CNM). Providers either managed labor independently or together as a team, MD with a CNM. There was no significant difference in length of first stage or total labor for subjects according to the obstetric provider that managed their labor. There was a significant difference found for second stage. Some subjects had significantly (F=.024) shorter second stage depending on the provider managing their labor.

The Effect of Type of Medication Administered and Its Effect on Length of Labor

There were nine variations of medications given to subjects for the regional analgesia they received during labor. There was no significant increase or decrease of any of the stages of labor found in groups 1-4 for any particular mixture of opioid and/or local anesthetic. Specifically for the ITA and CSE group there were primiarily three combinations of drug injected for the subarachnoid analgesia.

The combinations were as follows: (1) Bupivacaine 2.5 mg, Fentanyl 25 μg, and Epinephrine 200 μg. (2) The above combination with the substitution of 3 mg of bupivacaine. (3) The above combination with a substitution of Sufentanil 10 μg for the Fentanyl. There was no significant difference in length of each stage of labor for the above drug combinations. Mean length of stage one labor for each combination was as follows: (1) 141.8 minutes (71 cases); (2) 166.7 (17 cases) and (3) 157.95 (21 cases). Mean length of stage two: (1) 62.1 (2) 55.2 and (3) 69.0. Finally, mean length of total labor for each group was:

(1) 203.9 (2) 221.9 and (3) 221.6.

Number of Top-Ups for Each Anesthetic Group 1-3

The number of additional doses of medication was recorded during the chart review. For CSE and EPI groups, top-ups (additional re-dosing) occurred through the epidural catheter. For the ITA groups, five additional doses were given, for this group it signifies repeat injection of a medication mixture during a second sub-arachnoid puncture. Table 12 describes the number of top-ups for each anesthetic group and the number of subjects in that group.

Table 12.

Number of Top-Ups for Groups 1-3

Anesthetic Type:	#Top-Ups: 1	2	3	4	5	6
CSE	35	15	6	2	1	0
EPI	5	6	0	1	0	1
ITA	5	0	0	0	0	0

*The number in the table signifies n of subjects who received that particular number of top-ups.

CHAPTER FIVE

Conclusions

Overview of the Study

A retrospective chart review was conducted to collect information about parturients who receive regional analgesia/anesthesia during labor. Epidural analgesia/anesthesia has been used for women in labor since the 1930's. Several studies have been done to describe the risks and benefits for the parturient who receives epidural pain control. Concerning length of labor a controversy exists. The argument surrounds whether or not epidural technique prolongs length of first and second stage labor.

Intrathecal and combined spinal epidural techniques were developed as alternative modes of regional analgesia to circumvent the possible incidence of prolonged labor associated with epidural method of pain control. The purpose of this study was to examine all three of these methods, the Epidural (EPI), Combined Spinal Epidural (CSE), and Intrathecal (ITA) and their effect on length of each stage of labor as compared to those parturients who receive no regional analgesia/anesthesia, IV analgesia or no method of analgesia (NR/IV/None).

Characteristics of the Study Sample

The original goal of the retrospective review was to review two-hundred charts, fifty subjects in each group: CSE, EPI, ITA and NR/IV/None. The chart review took place in two phases: chart identification and then actual chart review. During chart identification charts were wrongly identified as receiving one method of regional analgesia, when in fact it was found they had received another method. The subjects were sorted into the proper group at the time of chart review. The chart review placed a weighty strain on the medical records department, for this

reason, additional chart retrieval to achieve fifty subjects in each group was abandoned.

Two hundred thirteen charts were reviewed in this study. A disparity exists in the number of charts reviewed for each group as described above. There were 76 subjects were in the CSE group, 41 in the EPI group, 40 in the ITA group, and 47 in the NR/IV/None group. When the chart review was conducted it was discovered that documentation in the labor and delivery log of several patients having had received an intrathecal or epidural injection was inaccurate and they had actually received combined spinal epidural technique according to the anesthesia record. Subjects were then placed in the CSE group, thus, the CSE group ended up with a large sample of subjects. Unequal number of subjects in each groups may affect results for some of the data.

Subjects in each group, 1-4, were similar with respect to maternal age, height, weight, gestation, and cervical dilation at the time of injection (groups 1-3 only). Maternal age, height, weight, and gestation had no statistically significant effects on what was measured for this study, the length of each stage of labor. The majority of the sample was Caucasian, 64.8% (138/213) while there were 26.3% (56/213) Black, 4.7% (10/213) Hispanic, and 4.2% (9/213) Asian. Distributions of race between study groups was fairly similar and did not present a statistically significant effect on length of labor.

Some subjects were excluded from data analysis of length of labor due to cesarean section. Thirty one of the two hundred thirteen subjects were excluded, thus the cesarean section rate for this study was 14.6%. Therefore, 182 of 213 (85.4%) charts were included in the analysis for mean length of each stage of labor. The cesarean section rate was greatest in the epidural group, 13 subjects (31.7%) and second greatest in the combined spinal epidural group, 15 subjects (18.4%). In reviewing the charts it was found that many of the patients who had epidural

analgesia/anesthesia went to cesarean section late in transition, 8 or 9 cm, or after complete cervical dilation, due to maternal exhaustion, failure to progress, cephalo-pelvic disproportion or fetal distress. An explanation for the increased incidence of cesarean section among the epidural group could be that many of these patients may have already been experiencing protracted labor before the epidural was placed and progress of labor was not improved with pain relief. Also, it was analyzed that the EPI and CSE groups had the most subjects who were VBAC, that is attempting vaginal birth after previous cesarean section, (9 subjects (22.5%) for the EPI group and 8 subjects (10.8%) for the CSE group). This could explain an increase in cesarean section rate, parturients who attempt VBAC are already at higher risk for caesarean section. Also, VBAC subjects may have had regional analgesia, an epidural, with their previous trial at labor and vaginal delivery and are more likely to ask for it again. Another explanation is that subjects who experience prolonged, painful labor may be more likely to ask for pain control with regional analgesia. Thus creating an increased incidence in cesarean section rate among regional groups, since these women may be at higher risk of cesarean section already, due to prolonged labor initially.

Incidence of cesarean section was lowest in the ITA, 2 subjects (4.1%) and NR/IV/None, 1 subject (2.1%), groups. VBAC subjects were also lowest for these groups, 3 subjects (6.5%) and 2 subjects (4.3%) respectively. Explanation for such a low incidence of cesarean section could be that patients were progressing so well they did not ask for regional analgesia or if they did, ITA was preferred by the obstetric and anesthesia provider. ITA is preferred later in labor because it is a relatively quick procedure, with little or no chance of motor blockade which would prolong second stage labor. Also, since there was a low incidence of VBAC subjects in these

two groups, ITA and NR/IV/None, they were not already at higher risk for cesarean section.

First Stage Labor

First stage labor is measured from the time that active labor commences until complete cervical dilation is attained. Onset of active labor is defined as the time of cervical change in dilation and effacement, with uterine contractions occurring every 2 - 3 minutes lasting at least sixty seconds. Analgesia, of any kind, is usually not provided for the patient until active labor is well established. From the data collected in this study, regional analgesia/anesthesia was not given until subjects were in active labor.

Rejection of Hypotheses:

Hypothesis I: It is hypothesized that there is no difference in the length of first stage labor for parturients receiving CSE and ITA as compared to those receiving EPI analgesia or NR/IV/None.

The first hypothesis states that the mean length of first stage for the CSE and ITA groups will not be different than the mean length of first stage labor for the EPI and NR/IV/None groups. The first hypothesis is rejected. It was found in the data analysis section that all methods of regional analgesia (CSE, EPI, ITA) studied in this sample decreased mean length of stage one labor as compared to the no regional group (NR/IV/None). The ITA decreases length of stage one most significantly compared to the NR/IV/None group, as well as significantly decreasing length of stage one as compared to the remaining two groups, CSE and EPI. There was no statistically significant difference between CSE and EPI groups. ITA may decrease overall mean length of stage one because it provides the patient with relief of pain associated with stage one labor at the level of the dorsal horn of the spinal cord, by blockade of nerves that carry pain,

through opioid mechanisms. Blockade of pain reduces the release of maternal catecholamines which have been thought to interfere with strength of uterine contractions, inhibit pelvic relaxation, preventing fetal descent, thus prolonging first stage labor. It does not cause blockade of autonomic, sensory, or motor nerves since there is very little local anesthetic injected, thus is less likely to prolong first stage labor. Unlike patients who receive epidural analgesia these patients have the opportunity to ambulate in labor, which can also help labor progress more swiftly.

Similarity of the CSE and EPI groups results may be explained by two effects. First, as mentioned previously, those subjects who request regional analgesia may already be at risk for protracted labor since they are experiencing pain and longer first stage labor before injection. Second, that the CSE groups are subject to additional doses of local anesthetic and/or opioid through the epidural catheter, which over time, can cause effects similar to the EPI group alone.

Finally, the regional analgesia/anesthesia groups may exhibit decreased length of first stage labor because for this study it was measured as, the time elapsed from time injected until complete cervical dilation. These groups would have significantly shorter first stage if the injection did not occur close to the onset of active labor. To address this, analysis of rate of first stage labor before and after injection follows later in this chapter.

Stage Two Labor

Stage two is defined as the time of complete cervical dilation until delivery of the fetus. This is the pushing stage. No subjects received regional analgesia/anesthesia during this stage.

Hypothesis 2: It is hypothesized that there is no difference in the length of second stage labor and inceidence of instrumental delivery for partureints receiving CSE and ITA as compared

to those receiving EPI analgesia or NR/IV/None.

The second hypothesis states mean length of second stage for the CSE and ITA groups will not be different than the mean length of second stage for the EPI group the NR/IV/None group. This hypothesis is rejected. Results obtained show that the mean length of second stage for the NR/IV/None group was significantly less as compared to the CSE and EPI groups. Mean length of second stage for ITA group was significantly less as compared to the CSE group, but not the EPI group. Length of second stage for the ITA group was not significantly different than the NR/IV/None group. The CSE had the longest second stage but not significantly different than the EPI group.

Reasons for an increase in the mean length of second stage labor for the CSE and EPI groups may center around the type and frequency of medication injected. These groups are often dosed with opioid and local anesthetic, of which, the local anesthetic can block autonomic, sensory, and motor nerves. Recall, Friedman associates prolonged second stage with regional analgesia/anesthesia associated with inhibition of the perineal reflex, which he attributes to ineffective pushing and inability to expel the fetus. Also, that the local anesthetic may inhibit motor nerves interfering with effective pushing. Another factor that could be contributing to longer second stage for the CSE group is the group consisted of 52/76 primiparas (68.4%), as compared to the NR/IV/None group which consisted of 32/47 multiparas (68.0%). Longer second stage is expected for primiparas as compared to multiparas.

Another factor which may influence the results obtained is that those who receive opioid analgesia through regional technique may have complete relief of pain. Experiencing comfortable first stage labor may affect motivation for pushing effectively during second stage. That is,

women who are not in pain may not be as motivated to push the baby out as compared to those who have not received regional analgesia and are motivated by pain to get the process over with.

Total Length of Labor

Total length of labor is calculated by adding stage one and stage two together. For this study it was calculated as the time of injection until complete cervical dilation for groups 1-3. For group 4 it was calculated by adding stage one and stage two documented in the labor record.

Hypothesis 3: It is hypothesized that there is no difference in the length of total labor for the CSE and ITA groups as compared to those receiving EPI analgesia or NR/IV/None.

The third hypothesis states that mean length of total labor for CSE and ITA groups will not be different than the mean length of total labor for the EPI and NR/IV/None groups. This hypothesis is rejected. It was found in the data analysis that the ITA group had the greatest effect on decreasing total length of labor. Mean length of total labor was significantly less for the ITA group (127.87 minutes) as compared to the remaining three groups. CSE and EPI were very close in the mean length of total labor, 270.57 and 267.22 minutes respectively, and the NR/IV/None group had the longest mean length of total labor, 346.30 minutes, which is not significantly different than CSE and EPI. These results are a summation of the effects each group had on stage one and stage two. Therefore, the ITA group had the greatest effect on total labor as a whole.

Dilation At Time of Injection

Since length of first stage was calculated for groups 1-3 as time elapsed from injection until complete cervical dilation, an analysis of dilation at time of injection was accomplished to determine if there were any significant differences for groups 1-3. Also, if regional analgesia is

requested late in labor, cervical dilation greater than 6 or 7 cm, many anesthesia and obstetric providers prefer to give ITA as opposed to the other methods of regional analgesia. If it was determined that the data showed one group was consistently injected later in labor, it could be part of the explanation for the decrease in length of first stage. As discussed in the data analysis chapter the mean cervical dilation, for groups 1-3, at the time of injection was 4.76. The mean dilation at time of injection was 4.45 for the CSE group, 4.34 for the EPI group, and 5.53 for the ITA group. There is no significant difference in the mean dilation between groups. Therefore, dilation at time of injection does not account for the significant decrease in mean length of first stage for ITA as compared to CSE and EPI.

Mean Length of Stage One According to Parity

Primiparas: Recall Table 1, from chapter two, mean length of stage one for primiparas and multiparas according to Friedman. He determined through his vast computer analysis of the lengths of labor of 10,293 subjects, that mean length of first stage labor for primiparas is 798 minutes (13.3 hours). Mean length of stage one for both primiparas and multiparas who did not receive regional anesthesia in this study was 320.5 minutes (5.3 hours). Mean length of stage one (all groups) for primipara was 208.12 (3.5 hours) for this study. For just primiparas in the NR/IV/None group it was 396.3 (6.6 hours). All of these figures are well below the Friedman mean. It was found during data analysis that the ITA group had significantly shorter primipara first stage as compared to the remaining three groups. Primiparas in the CSE and EPI groups also had significantly shorter first stage as compared to those in the NR/IV/None group. There were no significant differences found for primiparas in the CSE and EPI groups. It can be said, then, that regional analgesia significantly decreases length of first stage labor for primiparas compared

to primiparas who receive no regional, IV analgesia, or no analgesia at all. The most significant decrease in length of first stage occurs in the ITA group.

Multiparas: Referring to Table 1 again, Friedman documented the mean length of stage one for multiparas is 450 minutes (7.5 hours). Again, mean length of first stage is well below this for all four groups of this study, 192.2 minutes (3.2 hours), for multiparas in the NR/IV/None group it was 284.9 minutes (4.7 hours). These differences for both primipara and multipara could be attributed to the study sample. The sample is derived from active duty or dependents of active duty military. This group may somehow have habits or factors that influence length of labor that were not measured by this study. Management of labor may be different than that of the parturients studied by Friedman. Also, the frequency of regional anesthesia is greater. The multiparas in the ITA and CSE group had significantly shorter first stage as compared to those in the NR/IV/None group. There were no differences between length of stage one for multiparas between EPI and NR/IV/None groups. There were no significant differences in length of first stage for multiparas between any of the anesthesia groups, CSE, EPI or ITA. Therefore, it can be said that ITA has the most significant effect on decreasing length of first stage for multipara as compared to those who receive no regional, IV analgesia or no analgesia at all. In addition, there is no significant difference in mean length of first stage labor for those multiparous women who receive CSE, EPI or ITA analgesia.

There was no difference between length of first stage of labor between primiparas and multiparas in any of the regional analgesia/anesthesia groups: CSE, EPI, or ITA. There was, however a significant difference in the length of first stage labor between primiparas and multiparas in the no regional group (NR/IV/None). You would expect a significant difference in

length of labor between first time and second time mothers. Therefore, it can be said that regional analgesia/anesthesia has the greatest effect on decreasing length of first stage of primiparas as compared to multiparas, since no significant difference exists between both parity groups for those who received regional analgesia/anesthesia.

In summary, ITA had the most significant effect on decreasing length of first stage for primiparas than for any other mode of regional analgesia or no regional analgesia at all. ITA also had significant effect on decreasing length of first stage for multiparas but only significant as compared to the NR/IV/None group. ITA does not significantly decrease length of first stage labor for multiparas as compared to the CSE and EPI groups. It is very difficult to account for this difference. Perhaps, it is that, primiparas are more subject to prolonged first stage of labor by receiving local anesthetic as compared to opioid analgesia delivered by ITA method. Perhaps cervical dilation occurs more readily in multiparas than primiparas, and is not subject to suppression by local anesthetics administered in the epidural space. Another explanation may be that once the epidural catheter is placed, subjects may not move as much as they did before the catheter was placed for fear it may become dislodged or inadvertently pulled out. Multiparas may have experienced epidural analgesia with previous deliveries and may not have the fears first time mothers do. Fear, like pain, stimulates the sympathetic nervous system which has been thought to interfere with progress of labor as previously discussed in Chapter Two.

Mean Length of Stage Two According to Parity

Primiparas: As described by the data analyzed in Chapter Four, CSE is the only regional analgesic/anesthetic group that significantly increases length of stage two for primiparas as compared to the NR/IV/None group. Recall, the CSE group had the highest percentage of

primiparas (68.4%) 52/76 and the NR/IV/None had the lowest percentage of primiparas (31.9%) 15/47. This could account for this difference. No other groups had significantly longer or shorter length of stage two for primiparas. Friedman states that primiparas mean length of second stage is 45.6 minutes. Mean length of second stage for primiparas in all four groups combined is 73.96 minutes, for primiparas in the NR/IV/None group it was 45.1 minutes. Second stage for primiparas in this study was prolonged according to the Friedman standard. This may be due to the reasons discussed previously. Subjects are comfortable and are not as motivated to push effectively, prolonging second stage.

Multiparas: Results for multiparas parallel the results for primiparas, significance was only reached between the CSE and NR/IV/None groups. There is a significant difference in length of second stage between primiparas and multiparas for all four groups. It can be said, then, that regional analgesia/anesthesia does not increase or decrease second stage labor any differently for primiparas as it does for multiparas. Mean length of stage two according to Friedman should be 19.2 minutes for multiparas. For this study the mean length of stage two for multiparas in all groups it was 34.3 minutes, and for multiparas in the NR/IV/None group, 16.7. The NR/IV/None group actually had a shorter second stage than the Friedman standard.

In summary, mean length of stage two is not different between primiparas and multiparas in any of the regional analgesia/anesthesia groups. Stage two is not significantly different in EPI or ITA groups as compared to the NR/IV/None group. Length of stage two is only increased for those primiparas and multiparas who receive CSE technique as compared to those who do not receive regional analgesia/anesthesia (NR/IV/None).

Mean Length of Total Labor According to Parity

Primiparas: Data analysis revealed that length of total labor is prolonged in the NR/IV/None group as compared to the three other groups, those primiparas who received regional analgesia/anesthesia. Thus, regional analgesia/anesthesia significantly decreases length of total labor for primiparas. There was no significant difference in the length of total labor for primiparas in the CSE groups as compared to the EPI group. Primiparas in the ITA group had the significantly shortest length of total labor as compared to the other regional groups, CSE and EPI and as compared to those primiparas who did not receive regional analgesia (NR/IV/None).

Therefore, primiparas who receive ITA method of analgesia had the shortest total labor as compared to those who have CSE, EPI, or no regional analgesia. Primiparas who had CSE or EPI analgesia had about equal length of total labor but had significantly decreased length of total labor as compared to the NR/IV/None group.

Multiparas: The only significant difference found in data analysis for multiparas was between ITA and NR/IV/None groups. Multiparas who received ITA had significantly shorter length of total labor as compared to those who did not receive regional analgesia, but no significant difference existed between those multiparas who received CSE, EPI ,or ITA analgesia/anesthesia.

There was no significant difference in length of total labor for primiparas as compared to multiparas in the EPI and ITA groups. There was a significant difference in length of total labor for primiparas as compared to multiparas in the CSE and NR/IV/None groups. Primipara total labor is longer in the CSE and NR/IV/None groups as compared to multiparas. These are results that are expected. There is no significant difference between the length of primipara and

multipara total labor in the EPI and ITA groups, therefore, EPI and ITA methods of analgesia/anesthesia have a greater effect on decreasing length of total labor for primiparas.

In summary, regional analgesia/anesthesia decreases length of total labor in primiparas, ITA having the most significant effect. CSE and EPI groups did not differ from one another, although they did decrease length of total labor for primiparas as compared to the NR/IV/None group. For multiparas, only the ITA method of regional analgesia/anesthesia significantly decreased length of total labor as compared to the NR/IV/None group. CSE and EPI groups did not significantly differ from the NR/IV/None group.

Rate of Labor Before and After Injection of Regional Analgesia

Rate of first stage labor before and after injection of groups 1-3 was calculated to determine if there was a difference. As discussed earlier in this chapter, there was no significant difference in cervical dilation at the time of injection between groups 1-3. Rate of labor before injection was not significant between groups 1-3, see data analysis section. Mean rate of labor for each group was also not significantly different as compared to rate of first stage labor for NR/IV/None group. So, it can be said that all subjects in groups 1-3 were progressing at the same rate of labor before injection and were not progressing significantly faster or slower than the mean rate of first stage labor for the NR/IV/None group.

Mean rate of labor after injection for groups 1-3 was then calculated. There were significant differences found here. Mean rate of labor after injection was significantly faster than mean rate of labor before injection for all three groups. Mean rate of labor after injection was significantly faster than the mean rate of first stage labor for the NR/IV/None group. Also, mean rate of labor after injection was significantly faster for the ITA group as compared to the CSE

group. There was no significant differences in the rate of labor after injection between the CSE and EPI group, or between the ITA and EPI group.

Therefore, rate of first stage labor is significantly faster after injection of all three methods of regional analgesia/anesthesia as compared to the no regional group and that the ITA has a faster rate of first stage labor as compared to the CSE group. ITA and EPI, and CSE and EPI have no differences in their rate of first stage labor.

Using the Friedman standard, mean rate of labor for primiparas is 1.2 cm per hour for multiparas 1.5 cm per hour. All groups were at or above the standard rate, according to Friedman, of first stage labor before injection. Explanation of this may be due to ITA relieving pain through opioid receptor mechanisms without blocking autonomic, sensory or motor nerves. Blockade of such nerves is associated with prolongation of first stage of labor. Blockade of autonomic nerves causes vasodilation, leading to decreased blood pressure, which causes decreased uterine blood flow. Decreased uterine blood flow is associated with decreased frequency and strength of uterine contractions. In contrast, ITA relieves pain and blocks the sympathetic outflow associated with pain and stress of labor. Sympathetic stimulation can result in vasoconstriction of the uterine vessels leading to ineffective contractions. Pain relief may also contribute to pelvic relaxation of the parturient, thus allowing fetal descent and better progress of labor. Finally, the CSE group may have had the slowest rate of first stage labor since it is the group with the greatest number of primiparas, which have longer first stage labor compared to multiparas.

Length of Each Stage of Labor According to Oxytocin Administration

The results of this study are in accordance with Friedman's findings pertaining to the effect of oxytocin on length of labor. Oxytocin does not speed up labor but does produce physoiologic labor in those parturients with poor progression of labor. When length of each stage of labor, first, second, and total labor are examined in relation to oxytocin administration, there are no significant differences in mean length of labor. Refer to Figure 9 in Chapter Four, length of stage one is similar for oxytocin induction, augmentation, and no oxytocin administration. The same follows for stage two and total labor. Referring to Table 6, CSE and EPI had the highest incidence of oxytocin administration, 62 of 76 subjects (81.6%) and 33 of 41 subjects (80.5%) respectively, the parturients in these groups received either oxytocin induction or augmentation. The ITA group also had a high incidence of oxytocin administration, 33 of 49 (67.4%) of subjects received oxytocin. Only 18 of 47 (38.3%) of the patients who did not receive regional analgesia/anesthesia (NR/IV/None) received oxytocin.

Most of the oxytocin was administered for augmentation, that is, given after active labor was underway, not to induce active labor. Two factors may be attributing to increased administration of oxytocin. First, oxytocin may be necessary to augment labor after injection of regional analgesia/anesthesia to maintain an adequate labor pattern. Subjects who receive oxytocin may have other factors associated with increased length of labor other than regional anesthesia, such as occiput posterior presentation or cephalo-pelvic disproportion. Second, obstetric providers at the facility in which this data was collected, may be more aggressive with management of labor, using oxytocin more liberally after active labor is established. Thus, labor augmentation required after regional analgesia/anesthesia may very well

be related to the above mentioned factors, not the actual analgesic technique.

Type of Delivery

Referring to Table 5 and Figure 10, the CSE and EPI groups had the highest incidence of cesarean section. Accordingly, these two groups also had the highest incidence of oxytocin administration, it can be considered that the parturients in these two groups were already predisposed to have protracted labor due an inadequate labor pattern related to cephalo-pelvic disproportion leading to failure to descend and failure to progress. The CSE group also had the highest incidence of instrumental delivery, this could be due to either failure of the mother to push effectively related to motor blockade, size of the infant, or fetal distress.

Infant Birth Weight

As demonstrated in the data analysis section, there was no significance in weight of infant prolonging first or second stage labor individually, but that infants over 4000 gms prolonged total labor. There was also an increased incidence of instrumental delivery and infants weighing over 4000 gms. Referring to Table 7, there were 29 infants of 208 who weighed over 4000 gms, n=10 were delivered by cesarean section (34.5%), n=3 (10.3 %) by instrumental delivery, and n=16 (55.2%) were delivered vaginally. Only 19 of 154 (12.3%) of infants weighing between 3001 and 4000 gms were delivered by cesarean section , the same number by instrumental delivery. Of the group weighing less than 3001 none were delivered by cesarean section, and only 3 of 25 (1.2 %) needed instrumental delivery. This illustrates the important relationship between size of the infant and type of delivery.

Obstetric Provider

As described in Chapter Four, there were ten obstetric providers who managed labor for

the subjects in this sample. Mean length of each stage of labor was examined according to obstetric provider. The only significant difference in the effect of obstetric provider on length of labor was for stage two. Shortened second stage was the result of certain providers. A difference in obstetric provider did not influence length of stage one or total labor. The difference in stage two could be the result of aggressive management of second stage. Either with oxytocin or instrumental delivery. Providers can influence the length of second stage by abruptly delivering the fetus by use of forceps or vacuum extraction.

Mediation Administered Regionally

There was no significance in the mixture of medication administered and an increase or decrease of length of labor. Mixtures of medications did not vary a great deal, some had slight difference in concentration of local anesthetic, while others slight difference in dose of opioid or equitable dose of different opioid. Differences only occurred in mode of administration as demonstrated earlier in this chapter, for example, CSE, EPI or ITA. ITA mode of delivering medication for pain relief is associated with shorter first stage and total length of labor. Specifically for ITA, the three most commonly used combination of drugs injected were: (1) 25μg fentanyl, 2.5 mg bupivacaine, and 200μg of epinephrine, (2) the above combination with a substitution of 3.0 mg bupivacaine and (3) the above combination with the substitution of 10μg of sufentanil for the fentanyl. Of course the difference between combinations 1 and 2 are minuscule. As mentioned above, there was no significant difference in length of first stage, second stage or total labor for the above drug combinations.

Repeat Doses

As shown in Table 8, repeated doses of CSE occurred more frequently than any other

anesthetic group. Patients were re-dosed either once or twice the majority of the time. Very few patients were re-dosed more than three or more times. After the effect of the intrathecal opioid has had time to subside, providing labor lasts that long, re-dosing of the CSE may cause results to more approximate those of the EPI group.

Limitations of the Study

The limitations of this study surround the study design and subject sample. This study was retrospective, which is not always able to account for all variables, some may not be apparent while conducting a chart review. The sample was also one of convenience. It was small, consisting of a very unique populous, those with access to care in a military facility. The study groups were not equal with respect to the number of subjects in each group. This inequality can effect the results, and it is difficult to measure the effect. Also, the protocol for intrathecal mixture of drugs is not strictly followed in clinical practice. A more exact study would have been prospective, using the same drug combinations for all subjects. In addition, inclusion criteria could be more strict, eliminating large infants, oxytocin patients, and instrumental delivery subjects from the data analysis.

Military Relevance

This study can be applied to other military populations. Intrathecal and combined spinal epidural techniques of regional analgesia/anesthesia offer an alternative to epidural pain control. Intrathecal, one time injection, is a relatively quick procedure, for parturients experiencing the pain of labor. It is also more acceptable to administer intrathecal narcotics later in labor, decreasing the incidence of prolongation of first or second stage. Combined spinal epidural technique offers the versatility of providing an intrathecal injection, while threading an epidural

catheter for future use for pain control or dosing for cesarean section. More importantly, it offers a potential decrease in manpower hours. Epidural method of analgesia/anesthesia either by intermittent bolus or continuous infusion requires anesthesia personnel to be physically present for administration and evaluation of effect. Intrathecally administered opioids, are a one time injection, producing a near immediate effect, and thus require less monitoring by the anesthesia provider. Most anesthesia departments require close monitoring by the anesthetist for the first half hour only after injection. Less monitoring by anesthesia personnel is acceptable since continuous fetal monitoring is the standard of care for most obstetric services. Adverse effects or suboptimal effects of ITA analgesia can be readily observed by the obstetric team, and when necessary, treated in consultation with the anesthesia service.

Conclusions

This is the first study to describe and compare the current methods of analgesia available to laboring women, and how they effect length of labor. The results of this study indicate that the method of analgesia does effect the length of labor.

(1) Intrathecal injection has the most statistically significant effect on decreasing length of stage one. Combined spinal epidural and epidural techniques also significantly decrease length of stage one as compared to those women who do not receive regional analgesia and who may or may not receive IV analgesia. Stage one for primipara and multiparas is decreased as well, in fact, primipara stage one is not significantly different than multipara stage one as would be expected based on how parity alone effects length of stage one.

(2) Length of stage two is significantly prolonged for those who receive combined spinal epidural and epidural analgesia as compared to those who do not receive regional analgesia.

Additionally, there is no difference in length of stage two for those who receive intrathecal analgesia as compared to those who do not receive regional analgesia. Regional analgesia does not have an effect on parity as it does in stage one. As expected, stage two is significantly longer for primiparas in all groups (CSE, EPI, ITA, and NR/IV/None) as compared to length of stage two for multiparas.

(3) Intrathecal analgesia has the greatest effect on total labor. Total labor is significantly less for those who receive intrathecal analgesia as compared to combined spinal epidural, epidural, and no regional analgesia. There is no significant difference in the length of total labor for those who receive the combined spinal epidural, epidural, or no regional analgesia. Intrathecal and epidural analgesia effect length of total labor in primiparas most significantly. Primiparous total labor is not significantly greater than multiparous labor in the ITA and EPI groups, where as, there is a statististically significant difference between primiparas and multiparas and length of total labor for the CSE and NR/IV/None groups, which is expected.

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